

**WATER RESOURCES DEVELOPMENT PROJECT**

**OPERATION AND MAINTENANCE  
MANUAL**

**LOCAL PROTECTION PROJECT**

**BRAINTREE-QUINCY, MASSACHUSETTS**

**HAYWARD CREEK**



**DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
WALTHAM, MASS.**

**NOVEMBER 1978**

OPERATION AND MAINTENANCE MANUAL  
FOR  
FLOOD PROTECTION WORKS  
HAYWARD CREEK  
BRAintree-QUINCY, MASSACHUSETTS

FOREWORD

The successful functioning of the Flood Protection Works is not assured solely by construction of a system of dikes, floodwalls, flood-gates, sluice gate structures, and other appurtenant structures. If the system is to perform the functions for which it was designed, it must be carefully maintained during periods of normal river stages and properly operated during flood periods.

The need for proper maintenance cannot be too highly stressed in view of the fact that large damages may be incurred through operating failure of a critical element in flood time, caused by deterioration; or damage that would have been eliminated by proper maintenance.

Necessary maintenance and proper operation require that responsible local persons have a thorough understanding of the functions of the various units of the system and the recommended methods of maintaining the system and operating it during flood emergencies. It is the purpose of this manual to provide complete information so that all parties may fully understand their responsibilities in maintaining and operating the flood protection system in accordance with the regulations prescribed by the Secretary of the Army as amplified by this manual.

The general flood control Regulations for Maintenance and Operation of Flood Control Works quoted herein were approved by the Acting Secretary of War on 9 August 1944. Upon establishment of the Department of Defense, the improvement of rivers and harbors and other waterways for flood control and other purposes, formerly under the jurisdiction of the Secretary of War, became the responsibility of the Secretary of the Army. Reference therein to the Secretary of War and War Department shall be construed to mean, respectively, the Secretary of the Army and the Department of the Army. Where reference is made to the District Engineer in the Regulations included in this manual, it shall be construed to mean the Division Engineer, New England Division, Corps of Engineers.

OPERATION AND MAINTENANCE MANUAL  
FOR  
FLOOD PROTECTIVE WORKS  
HAYWARD CREEK  
BRAINTREE-QUINCY

TABLE OF CONTENTS

<u>Paragraph No.</u>	<u>Title</u>	<u>Page</u>
1	Purpose of This Manual	1
2	Authorization and Location	1
3	Description of Project	2
4	Effectiveness of Protection	2
5	Construction History	2
6	Plans	2
7	Local Cooperation	2
8	General Rules and Regulations	3
9	Maintenance	6
10	Operation	6
11	Inspection and Reports	7
 <u>B. CHANNEL IMPROVEMENTS</u>		
12	Description	9
13	Maintenance	9
14	Operation	10
 <u>C. DIKE</u>		
15	Description	11
16	Maintenance	11
17	Emergency Repair Measures	13
 <u>D. DRAINAGE STRUCTURES - Sluice Gate and Gate Valve Structures</u>		
18	Description	17
19	Maintenance	17
 <u>E. OPERATIONS PLAN</u>		
20	Project Operation	19
21	Cooperation	19
 <u>F. PORTABLE PUMP</u>		
22	Portable Pump	20
 <u>G. DRAWINGS AND SPECIFICATIONS</u>		
23	Drawings and Specifications	21

APPENDICES

Appendix "A"

Regulations Prescribed by the Secretary of the Army

Appendix "B"

Standard Operating Procedure During Flood Periods

Appendix "C"

Inspection Report Forms

Appendix "D"

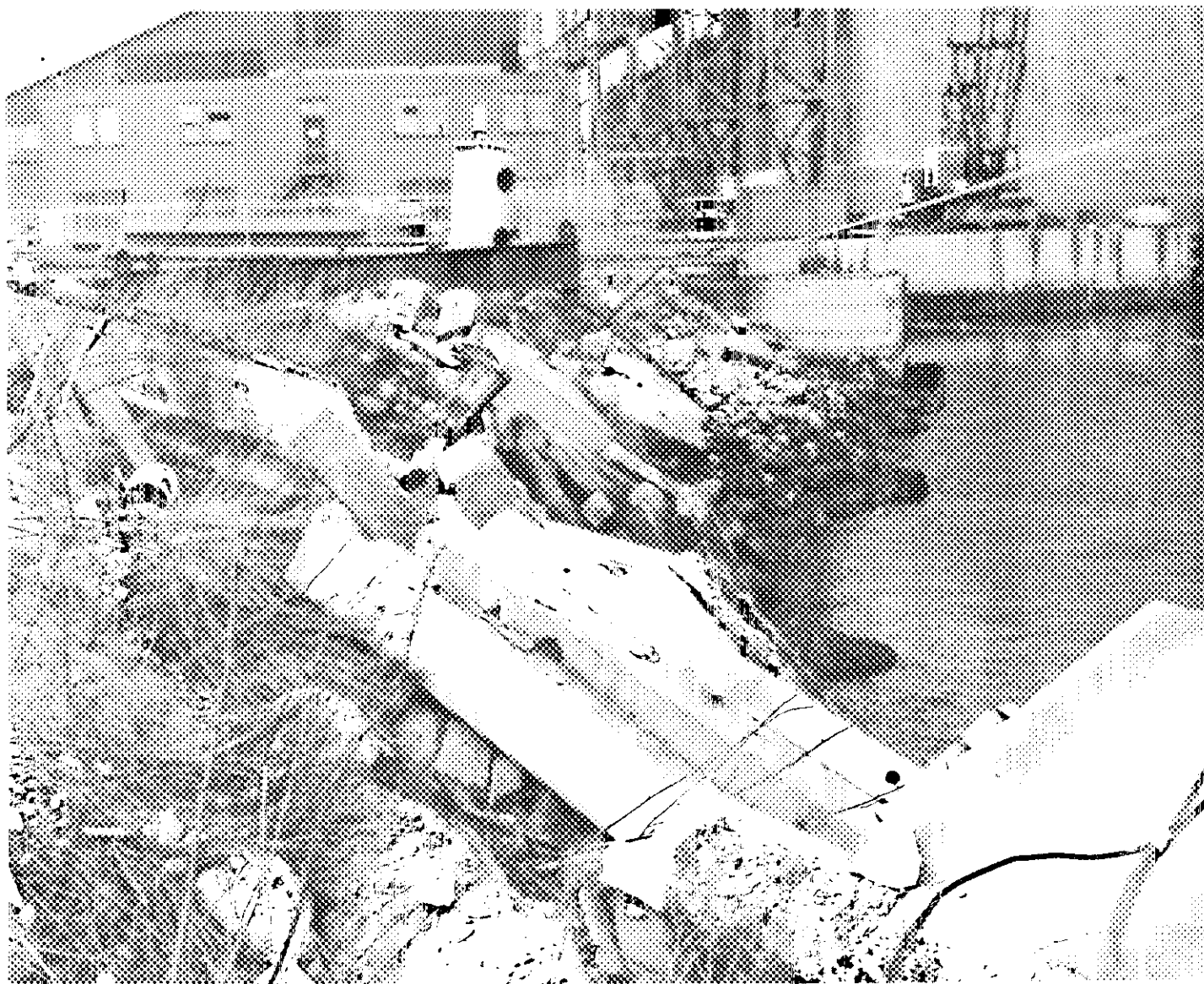
Assurances of Local Cooperation

Appendix "E"

Flood Emergency Measures

Appendix "F"

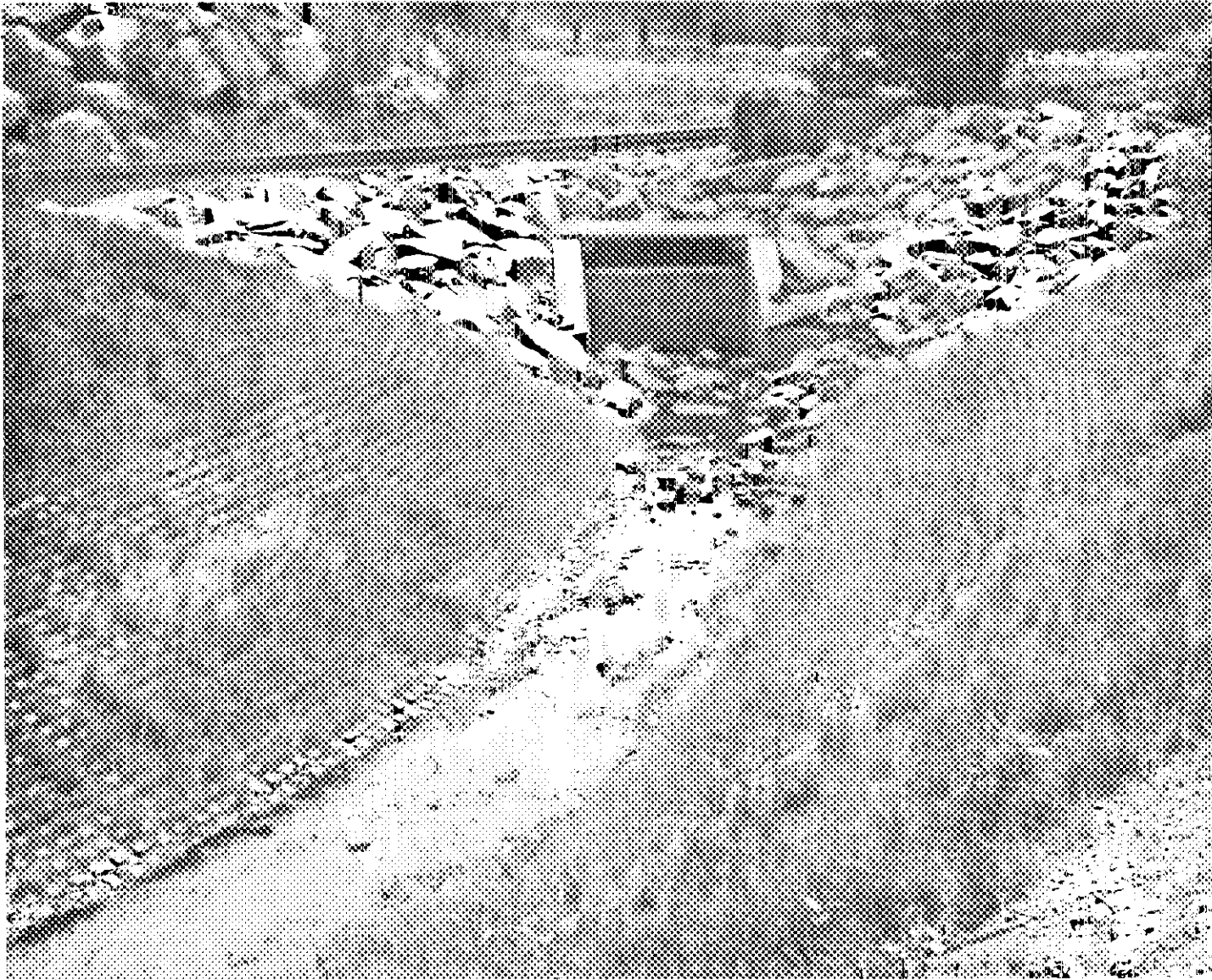
As-Built Drawings



OUTLET AREA OF 96" LINE BEFORE CONSTRUCTION



OUTLET AREA OF 96" LINE DURING CONSTRUCTION



NEW OUTLET STRUCTURE AT HAYWARD POND



## A. GENERAL

1. PURPOSE OF THIS MANUAL. Included in the authorization of the project are conditions specified by the Secretary of War to be met by local interests. One of these conditions is the Operation and Maintenance of the project after its completion. Under Assurances, dated 1 March 1976 and 19 March 1976, furnished to the Government by the town of Braintree and city of Quincy, the town of Braintree and city of Quincy have agreed to meet these conditions, and in particular, the operation and maintenance of the project after its completion. A copy of the above assurances is included in Appendix "D" of this manual.

The purpose of this Manual is to present detailed information to be used as a guide in complying with "Flood Control Regulations - Maintenance and Operation of Flood Control Works" as approved by the Acting Secretary of War on 9 August 1944, and published in this Manual as Appendix "A".

The regulations are intended to cover all local protection projects constructed by the Department of the Army throughout the United States, are general in nature, and obviously cannot give detailed instructions for the maintenance and operation of a specific project. The details set forth in this Manual for maintenance and operation of the Hayward Creek project are intended to supplement the Regulations to insure the maximum protection against floods for which the project was designed. Failure to maintain and operate the project as required by the Regulations and as detailed herein can result in severe property losses, loss of life, and irreparable loss of confidence in the flood protection system by citizens who have invested their funds on the basis of the protection afforded by the flood control works.

2. AUTHORIZATION AND LOCATION. Construction of the local flood protection project at Hayward Creek was authorized by Section 205 of the 1948 Flood Control Act, as amended by P.L. 93-351 (Water Resources Development Act of 1974), adopted 7 March 1974. Specific authority is contained in 1st Ind. dated 7 Jan 1975. The project is situated in the town of Braintree and the city of Quincy which are located in Norfolk County, Massachusetts approximately 10 miles south of Boston proper.

Hayward Creek is about one and one-half miles long. It rises in Braintree, east of Commercial Street and flows through a wetland area to Hayward Pond, also known as Eaton's Pond. From Hayward Pond, the creek follows along the Fore River Railroad tracks to West Howard Street from where it is piped to a depression on the upper west side of Quincy Avenue which is subject to tidal influence. From Quincy Avenue, the creek is conveyed in a conduit northeasterly across the General Dynamics Shipyard to Fore River.



3. DESCRIPTION. The project consists of the following: Diversion of Echo Creek into the wetlands by constructing a low dike across the creek at the northerly end of the wetland area; a new earth dam just upstream of the upper end of Hayward Pond; raising the Hayward Pond Dam about 4 feet and constructing a new outlet works; construction of 150 feet of concrete "I" wall and 100 feet of earth dike near the southeast portion of Hayward Pond; clearing, deepening and lining of the creek channel from the Hayward Pond outlet to West Howard Street. Installation of about 400 feet of 54 inch diameter and about 2,400 feet of 96-inch diameter reinforced-concrete pipe conduits to convey Hayward Creek flows from West Howard Street to Fore River. Installing a total of 750 feet of 36-inch, 48-inch and 60-inch drain pipes in the existing depression above Quincy Avenue to connect existing drains to the new Hayward Creek conduit.

4. EFFECTIVENESS OF PROTECTION.

a. General. The protective works at the Hayward Creek Basin provides for the utilization of available flood storage in Hayward Pond and the wetlands upstream of the pond to practical limits coupled with a new conduit system on lower Hayward Creek, between West Howard Street and Fore River.

b. Haywood Creek. The dual reservoir system will contain the 100-year storm runoff from the 253-acre upper drainage basin without overflow of the Hayward Pond dam. At an average spring tide level of El 6.0, or lower, the proposed drainage conduits on lower Hayward Creek would give complete protection against flooding from a 25-year storm and would limit flooding at the lowest point in West Howard Street to depths of only about 0.4 feet and 1.2 feet, respectively, should 50-year and 100-year storms occur.

c. Approach Channel and Conduits. The Hayward Creek improved channels, streambed and new conduits were designed for the 100-year storm runoff from the Hayward Creek Basin plus the outlet discharge from Hayward Pond. The design capacity of the channel and conduits is 33 cfs.

5. CONSTRUCTION HISTORY. The construction of the Hayward Creek local protection project was initiated in March 1977 and completed in August 1978 by J.F. White Construction Company of Newton, Massachusetts. The Federal cost of the project was approximately \$2,300,000.

6. PLANS. Plans pertinent to the operation and maintenance of the project are included for reference in Appendix "F" in this volume.

7. LOCAL COOPERATION. The authorizing legislation for the Hayward Creek Local Protection project was the Flood Control Act of 30 June 1948 (Public Law 858, 80th Congress) and reads as follows:

The Chief of Engineers recommended that, prior to construction, local interests give assurances satisfactory to the Secretary of the Army that they will:

- a. Provide without cost to the United States all lands, easements, and rights-of-way necessary for construction and maintenance of the project.
- b. Hold and save the United States free from damage due to the construction works, except damages due to the fault or negligence of the United States or its contractors.
- c. Maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of the Army.
- d. Provide without cost to the United States all alterations and replacements of existing utilities.
- e. Prescribe and enforce regulations to prevent encroachment on both the improved and unimproved channels and manage all project-related channels to preserve capacities for local drainage as well as for project functions.
- f. Comply with the provisions under Sections 210 and 305 of Public Law 91-646, 91st Congress, approved 2 January 1971 entitled Uniform Relocation Assistance and Real Property Acquisition Policies of 1970.

The assurances of the Commonwealth of Massachusetts, the Town of Braintree and the City of Quincy are contained in Appendix "D" of this volume. This manual is to assist the town and city in fulfilling c. above of their responsibilities for maintaining and operating the project.

8. GENERAL RULES AND REGULATIONS. Paragraph 208.10 (a) of the regulations prescribed by the Secretary of War gives general rules for the maintenance and operation of structures and facilities constructed by the United States for local flood protection. Applicable portions are quoted below to avoid the necessity for cross reference and are further defined by remarks under each quotation.

"(1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits."

These requirements cannot be overstressed, and town and city authorities must make adequate provisions for funds, personnel, equipment and materials to allow for the proper maintenance and operation of the flood protective works.

"(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee

consisting of or headed by an official hereinafter called the 'Superintendent', who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during the periods of low water, all without cost to the United States."

The committee shall be composed of competent members, preferably men experienced in engineering or construction work of a nature similar to the flood protection works. The committee must be given broad authority to carry out its responsibilities. The name, address, and office and home telephone numbers of the Superintendent, and any changes thereof, shall be promptly furnished the Division Engineer.

"(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times."

a. Central Location. Approximately 1,000 sand bags (these bags shall be feed-bag type) and 80 cubic yards of sand stored separately to fill them should be held in reserve in case it is necessary to stop leaks through the dikes and walls and to control sand boils and seepage behind the dikes and walls.

"(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities."

The disposal of rubbish, erection of fences, or barriers, the painting or erection of signs, the attachment of clothes lines to flood walls, or any form of trespassing on the project shall be prohibited.

"(5) No improvement shall be passed over, under, or through the walls, dikes, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the Division Engineer or his authorized representatives that such improvement, excavation, construction or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the Division Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the Division Engineer after completion of the work.

Any contemplated improvements or alterations as outlined above must be submitted to the Corps of Engineers, Waltham, Massachusetts, and the approval of the Division Engineer obtained prior to the town and city authorizing the work. All requests for approval shall be in writing and complete drawings in duplicate, one set of which shall be in reproducible form, must be submitted along with a full description of the work intended. The town and city will be held responsible for obtaining prior approval from the Corps of Engineers for any improvements or alterations proposed by itself, private parties or any public parties. The town and city shall furnish the Division Engineer as-built drawings, in duplicate, of the completed work.

"(6) It shall be the duty of the Superintendent to submit a semi-annual report to the Division Engineer covering inspection, maintenance and operation of the protective works."

See Paragraph 11 of this Manual for instruction on submitting reports.

"(7) The Division Engineer or his authorized representatives shall have access at all times to all portions of the protective works. The Division Engineer or his representatives will make periodic inspections of the protective works to determine if the project is being properly maintained and operated by the town and city. "Follow-up" inspections, when necessary, will be made to determine if deficiencies observed during the inspection have been corrected. A report with the results of each inspection will be furnished to the town and city for appropriate action."

"(8) Maintenance measures or repairs which the Division Engineer deems necessary shall be promptly taken or made."

The town and city should maintain the facilities and keep them in good repair and not wait for the Division Engineer to call such matters to its attention. Upon request, the Division Office will advise the town and city how to make any major repairs to the facilities.

"(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods."

The local authorities should formulate plans and negotiate agreements with local organizations and companies, who are operating facilities connected with the protective works, to insure that their activities will be properly coordinated with the Superintendent's organization during flood periods.

"(10) The Corps of Engineers with this document has furnished local interests with an Operation and Maintenance Manual for the completed project to assist them in carrying out their obligations under these regulations."

The flood control committee should familiarize itself with the contents of this manual. The authorities are encouraged to call on the Division Office of the Corps of Engineers for any additional advice or instructions required by them in carrying out the towns obligations for maintaining and operating the flood protection facilities.

#### 9. MAINTENANCE.

a. The work "maintenance" as used in this manual applies to the upkeep, repair and care of the work constructed by the United States and turned over to the town of Braintree and city of Quincy. If the work is neglected there will be deterioration and possible failure in flood time when there is dire need of dependable protection.

b. Satisfactory and dependable operation depends on constant maintenance. The organization that performs maintenance must be familiar with various parts of the system and will be in a position to use them effectively in time of stress.

c. Maintenance includes regular inspection of the entire system. The purpose of an inspection is to detect any deterioration or faulty operation that indicates a need for repair or replacement. This does not mean a casual automobile trip to places easily accessible but actually walking over every part of the system.

#### 10. OPERATION.

a. Operation in this manual refers to the actual use of the various features of the protection works during flood periods. It is intended that the procedure outlined herein under Appendix "B" will be sufficient to insure protection from floods to the design stage. However, advice relative to operation may be obtained at any time from the Reservoir Control Center (Telephone 617-894-2400, Ext. 627) of the New England Division Office.

b. Representatives of the Division Engineer stand ready to assist in the operation of the project. This in no way lessens the responsibility of the town and city in operating the project.

c. When abnormal river flows and stages are expected it is important that the Superintendent make immediate decisions and take prompt action and that he have the authority to carry out his decisions.

d. To insure correct operation it is essential that at least two persons (preferably 3) (1) be familiar with all phases of the flood protection works; (2) know the location of all gates and valves and when to close them; (3) know just what supplies and transport are on hand; and (4) know what men and tools can be mobilized for the patrolling and repair work.

e. The National Weather Service maintains the River Forecast Center at Boston, Massachusetts and is the official agency for collecting precipitation and runoff data.

f. It will be to the advantage of the local authorities to negotiate agreements with private owners and companies to operate and maintain project features that are directly related to facilities and property of those parties. However, the Corps of Engineers will look to the town and city for maintenance and operation of the project since the towns executed assurances of local cooperation.

11. INSPECTION AND REPORTS. The regulations prescribed by the Secretary of the Army call for semi-annual reports to be submitted by the Superintendent to the Division Engineer, covering inspection and maintenance. Inspection of the flood protective facilities shall be made immediately prior to flood seasons, immediately following floods, and otherwise at intervals not exceeding 90 days as required by the regulations.

To assist the Superintendent in making his inspections and reports, sample check list forms including blank NED Form 513 have been prepared and included in Appendix "C". The Superintendent shall have additional copies printed for use in submitting his reports.

The semi-annual reports shall be submitted in triplicate to the Division Engineer, Attn: Operations Branch, Operations Division, each February and August. The reports will be submitted in letter form with copies of the inspection forms covering the inspections made during the period of the report. The reports shall cover the following points:

a. A description of the maintenance work performed in the preceding six months.

b. The number and classification of men working on maintenance, regularly and intermittently.

c. Description of any work performed by contract on the repair or improvement of the project.

d. Description of use or operation of the system during the period being reported.

e. Suggestions relative to public cooperation and comments concerning public sentiment on the protection obtained are considered pertinent and desirable data for inclusion in the project, but such data are not required.



## B. CHANNEL IMPROVEMENTS

12. DESCRIPTION. The channel improvement covers the widening, deepening, and concrete paving grid lining of the channel for a distance of 720 linear feet, with the bottom width of 4 feet and 1 on 2 side slopes, the average depth is 3 feet.

13. MAINTENANCE. Paragraph 208.10 (g) (1) of the prescribed regulations sets forth rules for the maintenance of channels and floodways. These rules are quoted below, followed by brief comments on the particular applicability of these rules to the project.

### "Channels and Floodways.

"(1) Maintenance. Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

"(i) The channel or floodway is clear of debris, weeds, and wild growth."

All debris and growth which tend to restrict the channel shall be removed promptly.

"(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments."

Dumping of waste materials or any types of encroachment on the channel shall be prohibited and prompt steps shall be taken to remove or have removed any such encroachments.

"(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals."

Shoal areas should be removed but care should be exercised that the concrete paving grids protection is not displaced and that the slopes of the channel and existing banks are not undercut. Existence of shoal areas will be apparent from inspections during time of low flow.

"(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred."

Banks damaged by rain or wave wash or sloughing shall be repaired promptly, using bankrun gravel and concrete paving grids similar to that used in their original construction.

"(v) concrete paving grid sections are in good condition."

Concrete paving grid protection must be maintained in good condition to resist erosion. Any loss of rock due to slides, erosion or vandalism must be promptly replaced. Periodic checks should be made of the concrete grids for possible movement or loss of grid and prompt corrective action taken.

"(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works."

In order for this project to function properly and as designed, the improved channel between the dam and the downstream pressure conduits must be maintained in such condition that it is capable of carrying flood flows and not cause Hayward Creek to back-up, thus nullifying the effect of the improved channel.

"Such inspection shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and . . . dikes. The Superintendent shall provide for periodic repair and cleaning of debris . . . as may be necessary."

14. OPERATION. Paragraph 208.10 (g) (2) of the prescribed regulations gives rules for operation of channels and floodways. These rules which are quoted below are self-explanatory and require no amplification with regard to the project.

"(2) Operation. Both banks of the channels shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, concrete grids, . . . dikes and walls, drainage outlets, or other flood control structures repaired."

Rules and instructions for emergency repair measures for the dikes as given in Paragraph 17 are equally applicable to emergency repairs of the channel.

## C. DIKE

15. DESCRIPTION. An earth dike was built across Echo Creek to divert Echo Creek into the wetlands. The dike is approximately 40 feet long and 5 feet high. The top of the dike is at elevation 37 m.s.l., is 10 feet wide. The side slopes are at a 1 on 2. Dike is seeded to prevent erosion.

(1) Dike at Hayward Pond, built at South East corner of Pond to protect low area and apartment complex. The dike is 120 feet long, 1 on 2½ side slopes, top elevation is 27.0 ft. and top width 10 ft., side slopes have topsoil and are seeded.

An earth fill dam was built just upstream of the upper end of Hayward Pond replacing a existing breached structure. The dam has a unregulated spillway and will retain water during flood periods only. The dam is approximately 320 feet long and 15 feet high. The top of the dam is at elevation 32 m.s.l. and is 12 feet wide at the top, the side slopes are at a 1 on 2½, both sides with stone cover.

(2) The existing Hayward Pond Dam was raised approximately 4 feet to El. 25.5. The top was paved with macadam for a distance of approximately 760 feet. Dam is graded to meet existing paremend and is used as a roadway when required. An access ramp to the railroad crossing was also provided. The top is 25 feet wide, with slopes on each side covered by 18 inches of rock protection. The side slopes are 2.5 on 1.

(3) A concrete I-wall approximately 164 feet long was installed at centerline of dike to protect apartment house complex, the top of the dike is at El. 24.0 and the top of the I-wall is El. 27.0.

The maintenance regulations regarding dikes also apply to earth fill dams.

16. MAINTENANCE. Paragraph 208.10 (b)(1) of the prescribed regulations sets forth rules for the maintenance of levees. These rules quoted for levees apply equally to earth dikes and dams. Applicable portions are quoted below.

"Dikes. (1) Maintenance. The Superintendent shall provide at all times such maintenance as may be required to insure service-ability of the structures in time of flood. Measures shall be taken to provide the growth of sod, to exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

"(a) No unusual settlement, sloughing or material loss of grade or levee cross section has taken place;

"(b) No caving has occurred on either side of the levee which might affect the stability of the levee section;

"(c) No seepage, saturated areas, or sand boils are occurring;

"(d) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

"Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days; and such intermediate times as may be necessary to insure the best possible care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent."

Any unusual settlement, sloughing or caving should be corrected to restore the original dike grades. No major repair work shall be made without prior approval of the Division Engineer, in order that such repairs that may be necessary will not adversely affect the functioning of the protective facilities.

The slopes of dikes, and portions of the slopes of the wetlands dam were topsoiled and seeded to minimize the damage from erosion and scour caused by surface runoff. Maintenance of a sturdy sod growth on these embankments is highly important as sod is one of the most effective means of protecting the levee against erosion from rain, current and wavewash. Periodic mowing is essential to maintaining a good sod growth, and should be done at such intervals as necessary to keep down weeds and other noxious growth and to prevent the grass height from exceeding 12".

When sections of the dikes or dam require reestablishment of turf, seeding operations should be started at the earliest practical date in the spring to secure the greatest possible protection against erosion. Areas requiring seeding shall be dressed to fill gullies and irregularities in the surface. The following seed mixture was used in the original construction:

TABLE I

GRASS SEED

Kind of Seed	Proportion	Germination Minimum	Purity Minimum
Creeping Red Fescue	50%	85%	95%
Kentucky 31	30%	85%	95%
Domestic Rye	10%	90%	98%
Red Top	5%	85%	92%
Ladino Clover	5%	85%	96%

NOTE: Weed seed not to exceed 1.0% of total mixture.

17. EMERGENCY REPAIR MEASURES. Scours. Careful watch should be maintained of the dike for indication of scouring. If any indication of scouring is observed, soundings should be taken to observe the amount and progress of the scour. Sandbagging or dumped rock will generally afford the most practicable means of combatting this condition. The open ends of sandbags so used must be sewed or tied after filling.

Sand Boils. a. General. A sand boil is the result of a transfer of pressure head and seepage from the river, through a pervious stratum near or at the surface, to the landside of the dike. This seepage under pressure tends to push its way to the surface and actually floats the material through which it flows. No harmful effect results provided the weight of the relatively impervious soil layer overlying the previous stratum, in which the flow under pressure is occurring, is sufficient to counterbalance this pressure. When the soil stratum overlying the pervious layer is insufficient to counterbalance the upward pressure or when no such stratum exists, boils break through the surface on the landside wherever these weaknesses are present. The sand boil may discharge relatively clear water or the discharge may contain quantities of sand and silt, depending upon the magnitude of the pressure and the size of the boil.

b. Effects of Sand Boils. Sand boils can produce three distinctly different effects on the levee, depending upon the condition of flow under the levee. These three effects are illustrated in Appendix "E". In Figure 1, Plate No. I, the seepage flow develops a definite pipe or tube under the levee. This breaks out at the landside toe in the form of one or more large sand boils. Unless checked, this flow causes a cavern to be developed under the levee, resulting in subsidence of the levee and subsequent overtopping. This case can be most easily recognized by slumping of the levee crown. Figure 2, Plate No. I of Appendix "E", illustrates the case where seepage flows under pressure under the levee without following a defined path, as the case above. This flow results in one or more boils outcropping at or near the landside toe. The flow from these boils tends to undercut and ravel the slope, resulting in a sloughing of the slope. Evidence of this type of failure is found in undercutting and ravelling at the landside toe. Figure 3, Plate No. I, of Appendix "E", shows a third type of effect of a sand boil. In this case, numerous small boils, many of which are scarcely noticeable, outcrop at or near the toe. While no boil may appear to be dangerous in itself, the consequence of the group of boils is to cause flotation of the soil, thereby reducing the shearing strength of the material at the toe, where maximum shearing stress occurs, to such an extent that failure of the slope through sliding results.

c. General instructions for handling sand boils. All sand boils shall be watched closely. A sand boil which discharges clear water in a steady flow is usually not dangerous to the safety of the dike. However, if the flow of water increases and the sand boil begins to discharge material, corrective action shall be taken immediately.

d. Method of treatment.

(1) The accepted method of treating sand boils is to construct a ring of sandbags around the boil, building up a head of water within the ring sufficient to prevent further movement of sand and silt. The accepted method of ringing a sand boil, shown on Plate No. II of Appendix "E" is as follows:

(a) The entire base of the sack ring is cleared of debris in order to provide a watertight bond between the natural ground and the sack ring.

(b) The sacks are then laid in a ring around the boil, with joints staggered, and with loose earth between all sacks.

(c) The ring is carried only to a height sufficient to prevent material from being discharged. The ring should not entirely stop the flow of water, because of the probability of the excessive local pressure head causing additional ruptures of impervious strata and boils nearby.

(d) A "V" shaped drain constructed of two boards, or a piece of sheet metal, is then placed near the top of the ring to carry off water.

(2) Actual conditions at each sand boil will determine the exact dimensions of the ring. The diameter and height of the ring depend upon the size of the boil, and the flow of water from it. In general, the following considerations should govern:

(a) The base width should be no less than 1-1/2 times the contemplated height.

(b) It is well to include weak ground near the boil within the ring, thereby preventing a break-through later.

(c) The ring should be of sufficient size to permit sacking operations to keep ahead of the flow of water.

(3) Where many boils are found to exist in a given area, a ring levee of sandbags shall be constructed around the entire area and, if necessary, water pumped into the area to provide sufficient weight to counterbalance the upward pressure.

Sloughs. During prolonged high water stages, seeping and sloughing conditions on the landside slopes may occur. Such conditions should be observed closely as to progress of seepage up the landside slope and the amount of material that is being carried by seepage. If the seep velocity becomes great enough to cause, or probably cause, erosion or sloughing of the slope, a sandbag covering should be placed on the seeping area, beginning well out from the toe and progressing up slope. The covering should extend several feet beyond the saturated area. If the material is obtainable, the affected area should be covered with brush, straw or similar permeable material to a depth of two to four inches before placing the sandbag cover. This will permit the seep water to get away while serving as a filter to prevent loss of earth from the dike. After the covering is placed, close observation should be maintained and additional layers of sandbags placed on the previous ones until the velocity of the seepage is reduced to a point at which the amount of material carried is negligible. Sacking sloughs are illustrated on Plate No. III of Appendix "E".

Raising existing earth dikes. In an emergency, time and other conditions permitting, the grade of a dike can be safely raised three feet. The methods most commonly used for this purpose are outlined in the following paragraphs.

a. Sandbag topping. The sack ordinarily used for topping an earth dike shall be a grain or feed type sack (in lieu of canvas or sisal-craft type) which holds 100 pounds of grain. Smaller sacks may be used if feed sacks are not available. Grain sacks, filled with about one cubic foot of earth, weighing about 100 pounds, will provide a unit about six inches high, one foot wide and two feet in length.

The sacks may be filled at the source of material and hauled to the dike or filled from stockpile or borrow areas at the dike, conditions determining the method employed. The same is true of filling; i.e., whether power or hand methods are used.

The open end of the sacks should always face upstream or toward the riverside of the dike and need not be sewed or tied. When the sack faces the river the loose end should be folded under and when facing upstream the loose end covered by the succeeding sack.

The front line of sandbags in the first layer should be laid parallel to the dike center line and remaining bags at right angles to the center line. The sandbags in the second layer are all laid at right angles to the center line, the third row similar to the first, etc., as shown on Plate No. IV of Appendix "E". All sacks should be



lapped about 1/3 each way and well mauled or tramped into place. The sacks should be filled to two-thirds their capacity when flattened out to facilitate proper placing and prevent bursting the sack when mauled or tramped into place.

Plate No. IV of Appendix "E" illustrates the progressive method of increasing the dike height and gives an approximation of the number of sacks required for dikes of various heights. Plate No. V of Appendix "E" shows pictures of model sack dike or topping.

A crew of 50 men should fill, carry and place approximately 1,000 sacks per eight-hour day, all hand labor, when the source of material is within 150 feet of the point of placement. Production will depend on conditions at the site, location of storage and loading areas, and type of bag filling equipment used.

b. Lumber and sandbag topping is the most satisfactory method of raising low reaches of earth dike in emergencies. The chief objection is the time required to install. In putting on this topping, as well as any other topping, a careful line of levels should be run and grade stakes set in advance unless the dike top follows a dependable grade line. Two-by-four or two-by-six inch stakes should then be driven on the river side of the crown six feet apart and one-by-twelve inch boards nailed to land side of the stakes. This wall, backed with a single tier of sandbags, will hold out at least one foot of water. If the second foot is necessary, the layers of bags will have to be increased in number and reinforced. Sandbags are laid substantially in the manner described in a above. The stakes should be driven at least three feet into the ground, leaving at least three feet out, which will, in extreme cases, hold a three-foot topping properly braced behind the sandbags. Plate No. VI of Appendix "E" illustrates this method of raising a dike.

D. DRAINAGE STRUCTURES (Sluice Gate and Gate Valve Structures)

18. DESCRIPTION. The drainage sluice gate structures connected with the project are described below. See drawings for location of special and standard drain and sewer structures not included as a sluice gate structure. The structures are provided with gates, access covers, ladders, pipe railings, etc. as applicable to make a reliable, workable and complete installation.

a. Pertinent Data - Sluice Gate and Gate Valve Structures.

20" x 20"	Sluice Gate in permanent Pool Weir Manually Operated - Normally closed.
18"	Gate Valve with gate box and extended stem, Manually Operated - Normally open.
10"	Gate Valve with gate box and extended stem, Manually Operated - Normally open.

b. Construction. The sluice gate structure is of concrete construction with access through top of structure. See drawing for various types of construction covering drainage structures.

The gate valve gate box is a standard valve box with a cover at grade.

c. Pressure Conduits. At no time in the future shall the town permit anyone to tie into the pressure conduits. These pipe lines are a vital part of the overall protection, and considerable damage will result to project areas if other drain or sewer lines are connected to the pressure conduits.

19. MAINTENANCE. The lines and drains passing through the protection should be adequately maintained and any breaks or leaks promptly repaired. Where any excavations are necessary, backfills shall be carefully and thoroughly compacted, taking care that no voids or nests of cobbles or gravel are allowed to occur. Paragraph 208.10 (d) (1) of the prescribed regulations gives rules for the maintenance of sluice gate and other drainage structures.

1. "Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Gates on drainage and valve structures shall be examined, oiled, and trail operated at least once every 90 days. Periodic inspections shall be made by the Superintendent to be certain that:

"(a) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

"(b) Inlet and outlet channels are open;

"(c) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

"(d) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

"Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditons disclosed by such inspections."

2. The stems of all gates should be kept completely coated with a water resistant lubricant at all times to prevent corrosion and provide lubrication. All drainage structures shall be inspected at least once a year and all collected debris shall be removed.

3. All metal surfaces not otherwise protected must be kept painted to maintain the metal in good condition. The exterior and interior metal work, such as ladders, sluice gates, pipe railings and cover plates, exterior gate hoist and flap valves, will require frequent painting because of exposure to the weather and/or to waters.

#### E. OPERATIONS PLAN

20. PROJECT OPERATION. A plan of operation for floods is covered in Appendix "B". Severe floods can occur at any time of year. Fortunately, a few hours warning time should be available for local authorities to mobilize men and equipment for serious flood conditions.

21. COOPERATION. Representatives of the Division Engineer stand ready to assist the town and city in the operation of the project.

#### F. PORTABLE PUMP

22. PORTABLE PUMP. One portable gasoline engine driven, centrifugal pump has been furnished. The pump has a capacity of 550 GPM at a suction head of 8 feet; and total operating head of 30 feet. The pump has an electric starter and is the type that is towed by a truck or tractor. The pump has 60 feet of 4" hose in 10 foot lengths.

The batteries for starting pump engine will be fully charged at all times.

The maintenance and operator's manual for the gasoline engine is furnished with the engine and stored with the pump unit. Pump will be stored in the Town of Braintree.

#### G. DRAWINGS AND SPECIFICATIONS

23. DRAWINGS AND SPECIFICATIONS. A full sized set of plans showing the project as actually constructed will be furnished the town of Braintree and city of Quincy at the time of completion and transmittal of this manual; reduced prints of these drawings pertinent to the operation and maintenance of the project are included for reference in Appendix "F".

APPENDIX A

REGULATIONS PRESCRIBED BY THE  
SECRETARY OF THE ARMY



# TITLE 33—NAVIGATION AND NAVIGABLE WATERS

## Chapter 11—Corps of Engineers, War Department

### PART 208—FLOOD CONTROL REGULATIONS MAINTENANCE AND OPERATION OF FLOOD CONTROL WORKS

Pursuant to the provisions of section 3 of the Act of Congress approved June 22, 1936, as amended and supplemented (49 Stat. 1571; 50 Stat. 877; and 55 Stat. 634; 38 U. S. C. 701c; 701c-1), the following regulations are hereby prescribed to govern the maintenance and operation of flood control works:

**§ 208.10 Local flood protection works; maintenance and operation of structures and facilities.—(a) General.** (1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the right-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the War Department or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the Superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representative shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations.

(b) **Levees.—(1) Maintenance.** The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) The drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No settlement work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days, and such intermediate times as may be necessary to insure the best possible care of

the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(3) **Operation.** During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) **Flood walls.—(1) Maintenance.** Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) The drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(3) **Operation.** Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) **Drainage structures.—(1) Maintenance.** Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on

drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) *Operation.* Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(c) *Closure structures.*—(1) *Maintenance.* Closure structures for traffic openings shall be inspected by the superintendent every 90 days to be certain that:

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

(iii) All movable parts are in satisfactory working order;

(iv) Proper closure can be made promptly when necessary;

(v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) *Operation.* Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given

in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

(f) *Pumping plants.*—(1) *Maintenance.* Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) *Operation.* Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) *Channels and floodways.*—(1) *Maintenance.* Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections and deflection dikes and walls are in good condition;

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) *Operation.* Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

(h) *Miscellaneous facilities.*—(1) *Maintenance.* Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) *Operation.* Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor. (49 Stat. 1571, 50 Stat. 877; and 55 Stat. 638; 33 U.S.C. 701c; 701c-1) (Regs. 8 August 1944, CE SPEWF)

(SAL)

J. A. ULIO,  
Major General,  
The Adjutant General.

(P. H. Doc. 44-12286; Filed, August 16, 1944; 9:44 a.m.)

APPENDIX B

BRAINTREE-QUINCY LOCAL PROTECTION PROJECT

STANDARD OPERATING PROCEDURE

DURING FLOOD PERIODS

## APPENDIX B

### STANDARD OPERATING PROCEDURE

#### BEFORE AND DURING FLOOD PERIODS

If the National Weather Service announces a hurricane warning or a heavy rainfall warning within six hours, river levels at the project should be monitored. The following outlines the procedure to be followed in operating the portable pump and gate mechanism at the Hayward Pond dike, to prevent flooding of the apartment building and adjacent low lying area on the landward side of the structure.

When standing water on the landward side of the dike reaches elevation 21.5 (i.e., landward end of drain pipe about one-third submerged) and is expected to continue to rise, then the pump will be removed from storage, set up on the dike, and tested. The gate mechanism should also be tested at this time.

When standing water on the landward side of the dike reaches elevation 22.5 (i.e., landward end of drain pipe totally submerged), the gate in the conduit will be closed and the pump started. Pump to maintain a water level on the landward side of the dike of between 21.5 and 22.5 feet.

Remain staffed until pond level recedes to elevation 21.5. If the pond level is still receding and expected to continue, open gate and secure from operation.

Weather and precipitation forecasts should then be monitored, in that a recurrence of floodflows may necessitate a re-staffing of the project.

APPENDIX C

INSPECTION REPORT FORMS

# LOCAL FLOOD PROTECTION PROJECT INSPECTION REPORT

Project:

Maintaining Agency:

Type Inspection:            Semi-Annual Staff            90 Day Interim

River Basin:

Date of Inspection

Feature	Sat	Unsat	Deficiencies
---------	-----	-------	--------------

## PUMPING STATIONS - STRUCTURES

INTERIOR			
EXTERIOR			

## PUMPS - MOTORS - ENGINES

TRIAL OPERATED			
GENERAL CONDITION			
POWER SOURCE			
INSULATION TESTS			
METAL INTAKES/OUTLETS			
GATE VALVES			

## GATES - DRAINAGE STRUCTURES

TRIAL OPERATED			
GENERAL CONDITION			
LUBRICATION			

## DIKES - DAMS

GENERAL CONDITION			
SLOPES/EROSION			
SAND BOILS/CAVING			
TRESPASSING			
SLOPE PROTECTION			
DRAINS			

## STOP-LOGS - LOG BOOM

CONDITION OF LOGS			
AVAILABILITY OF LOGS			
HIGHWAY SLOTS			
STORAGE FACILITIES			

## CHANNELS - OUTLET WORKS CHANNEL

WORKS			
OBSTRUCTION CONTROL			

Feature	Sat	Unsat	Deficiencies
<b>CONCRETE STRUCTURES</b>			
SURFACE			
SETTLEMENT			
JOINTS			
DRAINS			

<b>MISCELLANEOUS</b>			
EMERGENCY OPER. PLAN			
EMERGENCY EQUIPMENT			
SEMI-ANNUAL REPORT			

**Inspection Party:**

**Photographs Taken:**

**Remarks & Additional Comments:**

( Indicate Here Observations, Discussions, Specific Feature Deficiencies, Recommendations and any other pertinent information. Use Continuation Sheet if necessary. )

X ALL APPLICABLE ITEMS. IF UNSAT INDICATE SPECIFIC DEFICIENCIES. INDICATE IF NOT APPLICABLE.

DATE	INSPECTED BY: TYPED NAME & TITLE	SIGNATURE
------	----------------------------------	-----------



APPENDIX D

ASSURANCES OF LOCAL COOPERATION

TOWN OF BRAINTREE AND CITY OF QUINCY

MASSACHUSETTS

AGREEMENT BETWEEN  
THE COMMONWEALTH OF MASSACHUSETTS

AND THE CITY OF QUINCY

FOR LOCAL COOPERATION AT

HAYWARD CREEK LOCAL PROTECTION PROJECT

HAYWARD CREEK, QUINCY/BRAINTREE, MASSACHUSETTS

THIS AGREEMENT entered into this 19TH day of  
MARCH, 1976 by and between the COMMONWEALTH OF

MASSACHUSETTS, (hereinafter called the "Commonwealth"), acting by the  
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING, through the Division of  
Waterways and the City of Quincy (hereinafter called the "City") acting  
by and through the Mayor of the City of Quincy,

WITNESSETH THAT:

WHEREAS, construction of the local flood protection project at Hayward  
Creek, Quincy/Braintree, Massachusetts (hereinafter called the "Project"),  
was approved on 28 March 1975 by the Chief of Engineers of the Army Corps  
of Engineers under authority of Section 205 of the Flood Control Act of  
1948, as amended by Section 61 of the Water Resources Development Act of  
1974, approved 7 March 1974, Public Law 93-251, 33 USCA 7018, and

WHEREAS, the City hereby represents that it has the authority and  
capability to furnish the non-Federal cooperation required by the Federal  
legislation authorizing the Project and by other applicable law;

NOW, THEREFORE, the parties agree as follows:

1. The City agrees that, if the United States of America, (hereinafter called the "Government") shall commence construction of the local flood protection project at Hayward Creek, Quincy/Traintree, Massachusetts, substantially in accordance with approval of the Chief of Engineers, dated 28 March 1975 under authority of Section 205 of the 1948 Flood Control Act, as amended, it shall in consideration of the Government commencing construction of such Project, fulfill the requirements of non-Federal cooperation, to wit:

a. Provide without cost to the Commonwealth all lands, easements, and rights-of-way necessary for the construction and maintenance of the Project.

b. Hold and save the Commonwealth free from damages due to construction works except damages due to fault or negligence of the Government or its contractors.

c. Maintain and operate all works after completion without cost to the Commonwealth in accordance with regulations prescribed by the Secretary of the Army.

d. Provide without cost to the Commonwealth all alterations and replacements of existing utilities.

e. Prevent future encroachment or development which might interfere with proper functioning of the project for flood control, including the adoption of building ordinances stipulating that all new buildings will have basement floor grades above, or be flood proofed to, elevation 26 feet above mean sea level (msl) in the vicinity of the Wetlands reservoirs, elevation 25 feet msl in the vicinity of Hayward Pond, and elevation 11 feet msl along the Hayward creek open channel and conduit downstream of Hayward Pond.

f. Assume thirty-five (35%) percent responsibility for all Project costs in excess of the Federal cost limitation of 2 million dollars.

2. The City further agrees to comply with requirements of non-Federal cooperation specified in Sections 210 and 305 of Public Law 91-646, 91st. Congress, S.1, approved 2 January 1971, known as the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970," to wit;

a. Fair and reasonable relocation payments and assistance shall be provided to or for displaced persons, as are required to be provided by a Federal agency under Sections 202, 203, and 204 of Public Law 91-646;

b. Relocation assistance programs offering the services described in Section 205 of Public Law 91-646 shall be provided to such displaced persons:

c. Within a reasonable period of time prior to displacement, decent, safe, and sanitary replacement dwellings will be available to displaced persons in accordance with Section 205 (c) (3) of Public Law 91-646;

d. In acquiring real property the City will be guided, to the greatest extent possible under its laws, by the land acquisition policies in Sections 301 and the provisions of Section 302 of Public Law 91-646; and

e. Property owners will be paid or reimbursed for necessary expenses as specified in Sections 303 and 304 of Public Law 91-646.

3. The City hereby gives the Commonwealth a right to enter upon, at reasonable times and in a reasonable manner, lands which the City owns or controls, for access to the Project for the purpose of inspection and for the purpose of completing, operating, repairing and maintaining the Project, if such inspection shows that the City for any reason is failing to complete, repair and maintain the Project in accordance with the assurances hereunder and has persisted in such failure after a reasonable notice in writing by the Commonwealth delivered to City Officials. No completion, operation, repair and maintenance by the Commonwealth in such event shall operate to relieve the City of responsibility to meet its obligations as set forth in paragraph 1 of this Agreement, or to preclude the Commonwealth from pursuing any other remedy at law or equity.

4. This agreement is subject to the approval of the Attorney General.

IN WITNESS WHEREOF, the parties hereto have executed this contract  
as of the day and year first above written

CITY OF QUINCY

Joseph J. LaRue  
Mayor, City of Quincy

Accepted:

David L. Audley  
Commissioner, Department of Environmental  
Quality Engineering

John J. Gannay  
Chief Engineer, Division of Waterways

Approved as to Form:

Edward J. Quinlan  
Assistant Attorney General

AGREEMENT BETWEEN  
THE COMMONWEALTH OF MASSACHUSETTS  
AND THE TOWN OF BRAINTREE  
FOR LOCAL COOPERATION AT  
HAYWARD CREEK LOCAL PROTECTION PROJECT  
HAYWARD CREEK, QUINCY/BRAINTREE, MASSACHUSETTS

THIS AGREEMENT entered into this 1st day of March, 1976 by and between the COMMONWEALTH OF MASSACHUSETTS, (hereinafter called the "Commonwealth"), acting by the DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING, through the Division of Waterways and the Town of Braintree (hereinafter called the "Town") acting by and through the Braintree Board of Selectmen,  
WITNESSETH THAT:

WHEREAS, construction of the local flood protection project at Hayward Creek, Quincy/Braintree, Massachusetts (hereinafter called the "Project"), was approved on 28 March 1975 by the Chief of Engineers of the Army Corps of Engineers under authority of Section 205 of the Flood Control Act of 1948, as amended by Section 61 of the Water Resources Development Act of 1974, approved 7 March 1974, Public Law 93-251; 33 USCA 701S; and

WHEREAS, the Town hereby represents that it has the authority and capability to furnish the non-Federal cooperation required by the Federal legislation authorizing the Project and by other applicable law;

NOW, THEREFORE, the parties agree as follows:

1. The Town agrees that, if the United States of America (hereinafter called the "Government") shall commence construction of the local flood protection project at Hayward Creek, Quincy/Braintree, Massachusetts, substantially

in accordance with approval of the Chief of Engineers, dated 18 March 1975 under authority of Section 205 of the 1918 Flood Control Act. It is further provided, it shall in consideration of the Government commencing construction of such Project, fulfill the requirements of non-Federal cooperation, to wit:

a. Provide without cost to the Commonwealth all lands, easements, and rights-of-way necessary for the construction and maintenance of the Project.

b. Hold and save the Commonwealth free from damages due to construction works except damages due to fault or negligence of the Government or its contractors.

c. Maintain and operate all works after completion without cost to the Commonwealth in accordance with regulations prescribed by the Secretary of the Army.

d. Provide without cost to the Commonwealth all alterations and replacements of existing utilities.

e. Prevent future encroachment or development which might interfere with proper functioning of the project for flood control, including the adoption of building ordinances stipulating that all new buildings will have basement floor grades above, or be flood proofed to, elevation 28 feet above mean sea level (msl) in the vicinity of the Wetlands reservoirs, elevation 25 feet msl in the vicinity of Hayward Pond, and elevation 11 feet msl along the Hayward creek open channel and conduit downstream of Hayward Pond.

f. Assume sixty-five (65%) percent responsibility for all Project costs in excess of the Federal cost limitation of 2 million dollars.

2. The Town further agrees to comply with requirements of non-Federal cooperation specified in Sections 210 and 305 of Public Law 91-640,

... , 1971, approved 2 January 1971, known as the "Relocation Assistance and Real Property Acquisition Policies Act of 1970," to wit;

a. Fair and reasonable relocation payments and assistance shall be provided to or for displaced persons, as are required to be provided by a Federal agency under Sections 202, 203, and 204 of Public Law 91-646;

b. Relocation assistance programs offering the services described in Section 205 of Public Law 91-646 shall be provided to such displaced persons;

c. Within a reasonable period of time prior to displacement, decent, safe, and sanitary replacement dwellings will be available to displaced persons in accordance with Sections 205 (c) (3) of Public Law 91-646;

d. In acquiring real property the Town will be guided, to the greatest extent possible under its laws, by the land acquisition policies in Sections 301 and the provisions of Section 302 of Public Law 91-646; and

e. Property owners will be paid or reimbursed for necessary expenses as specified in Sections 303 and 304 of Public Law 91-646.

3. The Town hereby gives the Commonwealth a right to enter upon, at reasonable times and in a reasonable manner, lands which the Town owns or controls, for access to the Project for the purpose of inspection and for the purpose of completing, operating, repairing and maintaining the Project, if such inspection shows that the Town for any reason is failing to complete, repair and maintain the Project in accordance with the assurances hereunder and has persisted in such failure after a reasonable notice in writing by the Commonwealth delivered to Town Officials. No completion, operation, repair and maintenance by the Commonwealth in such event shall operate to



relieve the Town of responsibility to meet its obligations as set forth in paragraph 1 of this Agreement, or to preclude the Commonwealth from pursuing any other remedy at law or equity.

h. This Agreement is subject to the approval of the Attorney General.

IN WITNESS WHEREOF, the parties hereto have executed this contract as of the day and year first above written.

TOWN OF BRAINTREE

[Signature]  
Chairman, Board of Selectmen

[Signature]  
Member, Board of Selectmen

[Signature]  
Member, Board of Selectmen

Accepted:

[Signature]  
Commissioner, Department of Environmental  
Quality Engineering

[Signature]  
Chief Engineer, Division of Highways

Approved as to Form:

[Signature]  
Assistant Attorney General

THE UNITED STATES OF AMERICA

AND

COMMONWEALTH OF MASSACHUSETTS

FOR LOCAL COOPERATION AT

HAYWARD CREEK LOCAL PROTECTION PROJECT

QUINCY/BRAINTREE, MASSACHUSETTS

THIS AGREEMENT entered into this 20th day of May, 1976 by and between the UNITED STATES OF AMERICA (hereinafter called the "Government"), represented by the Contracting Officer executing this agreement, and the COMMONWEALTH OF MASSACHUSETTS (hereinafter called the "Commonwealth"), acting by the Department of Environmental Quality Engineering and through its Division of Waterways, with the approval of the Governor, WITNESSETH THAT:

WHEREAS, construction of the local flood protection project at Hayward Creek, Quincy/Braintree, Massachusetts (hereinafter called the "Project"), was approved on 28 March 1975 by the Chief of Engineers under authority of Section 205 of the Flood Control Act of 1948, as amended by Section 61 of the Water Resources Development Act of 1974, approved 7 March 1974, Public Law 93-251; 33 USCA 701S; and

WHEREAS, The Commonwealth hereby represents that it has the authority and capability to furnish the non-Federal cooperation required by the Federal legislation authorizing the Project and by other applicable law.

NOW, THEREFORE, the parties agree as follows:

1. The Commonwealth agrees that, if the Government shall commence construction of the local flood protection project at Hayward Creek, Quincy/Braintree, Massachusetts, substantially in accordance with approval of the Chief of Engineers, dated 28 March 1975 under authority of Section 205 of the 1948 Flood Control Act, as amended, it shall in consideration of the Government commencing construction of such Project, fulfill the requirements of non-Federal cooperation, to wit:

a. Provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction and maintenance of the project.

b. Hold and save the United States free from damages due to construction works except damages due to fault or negligence of the United States or its contractors.

c. Maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of the Army.

d. Provide without cost to the United States all alterations and replacements of existing utilities.

e. Prevent future encroachment or development which might interfere with proper functioning of the project for flood control, including securing the adoption of building ordinances stipulating that all new buildings will have basement floor grades above, or be flood proofed to, elevation 28 feet above mean sea level (msl) in the vicinity of the Wetlands reservoirs, elevation 25 feet msl in the vicinity of Hayward Pond, and elevation 11 feet msl along the Hayward creek open channel and conduit downstream of Hayward Pond.

f. Assume full responsibility for all Project costs in excess of the Federal cost limitation of 2 million dollars.

2. The Commonwealth further agrees to comply with requirements of non-Federal cooperation specified in Section 210 and 305 of Public Law 91-646, 91st Congress, S.1, approved 2 January 1971, known as the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970," to wit;

a. Fair and reasonable relocation payments and assistance shall be provided to or for displaced persons, as are required to be provided by a Federal agency under Sections 202, 203, and 204 of Public Law 91-646;

b. Relocation assistance programs offering the services described in Section 205 of Public Law 91-646 shall be provided to such displaced persons;

c. Within a reasonable period of time prior to displacement, decent, safe, and sanitary replacement dwellings will be available to displaced persons in accordance with Sections 205(c) (3) of Public Law 91-646;

d. In acquiring real property the Commonwealth will be guided, to the greatest extent possible under its laws, by the land acquisition policies in Sections 301 and the provisions of Section 302 of Public Law 91-646; and

e. Property owners will be paid or reimbursed for necessary expenses as specified in Sections 303 and 304 of Public Law 91-646.

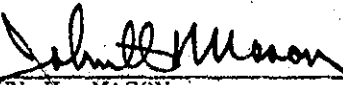
3. The Commonwealth hereby gives the Government a right to enter upon, at reasonable times and in a reasonable manner, lands which the Commonwealth owns or controls, for access to the Project for the purpose of inspection and for the purpose of completing, operating, repairing and maintaining the Project, if such inspection shows that the Commonwealth for any reason is failing to complete, repair and maintain the Project in accordance with the assurances hereunder and has persisted in such failure after a reasonable notice in writing by the Government delivered to Commonwealth Officials. No completion, operation, repair and maintenance by the Government in such event shall operate to relieve the Commonwealth of responsibility to meet its obligations as set forth in paragraph 1 of this Agreement, or to preclude the Government from pursuing any other remedy at law or equity.

4. This Agreement is subject to the approval of the Secretary of the Army.

IN WITNESS WHEREOF, the parties hereto have executed this contract  
as of the day and year first above written.

THE UNITED STATES OF AMERICA

By

  
JOHN H. MASON  
Colonel, Corps of Engineers  
Division Engineer  
Contracting Officer

DATE: 20 May 1976

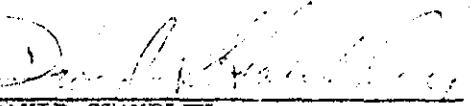
APPROVED:

  
WOODROW BERGE  
Director of Real Estate

FOR THE Secretary of the Army

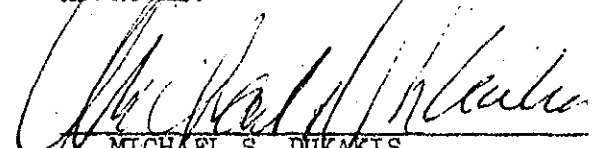
THE COMMONWEALTH OF MASSACHUSETTS  
Department of Environmental  
Quality Engineering

By

  
DAVID STANDLEY  
Commissioner

DATE: April 20, 1976

APPROVED:

  
MICHAEL S. DUKAKIS  
Governor

I have reviewed the foregoing Agreement and have considered the  
effect of Section 221 of the Flood Control Act of 1970, Public Law  
91-611, and I am satisfied that the Commonwealth can fully comply  
with the provisions of said Agreement. Accordingly, I approve the  
foregoing Agreement.

  
Attorney General

CERTIFICATION

I, Paul Guzzi, do hereby certify that I am Secretary of the Commonwealth; that David Standley, who signed this Agreement on behalf of the Commonwealth, was then the Commissioner of the Department of Environmental Quality Engineering; that said Agreement was duly signed for and on behalf of the Commonwealth; and that said Agreement is within the scope of the Commissioner's powers; and that Francis X. Bellotti was Attorney General at the time of his approval.

I further certify that Michael S. Dukakis was Governor of this Commonwealth on the date of approval of this Agreement.

*Paul Guzzi*

Secretary of the Commonwealth

SUPPLEMENTAL  
AGREEMENT BETWEEN  
THE UNITED STATES OF AMERICA  
AND  
COMMONWEALTH OF MASSACHUSETTS  
FOR LOCAL COOPERATION AT  
HAYWARD CREEK LOCAL PROTECTION PROJECT  
QUINCY/BRAINTREE, MASSACHUSETTS

THIS SUPPLEMENTAL AGREEMENT, No. 1, made and entered into this 30<sup>th</sup> day of November, 1976 to the Agreement for Local Cooperation at Hayward Creek Local Protection Project at Quincy/Braintree, Massachusetts, dated 20 May 1976, by and between the COMMONWEALTH OF MASSACHUSETTS and THE UNITED STATES OF AMERICA.

WITNESSETH:

WHEREAS, Section 133 (b) of the Water Resources Development Act of 1976, Public Law 94-587, approved 22 October 1976, amended Section 61 of the Water Resources Development Act of 1974 by increasing the Federal cost limitation from \$1,000,000. to \$2,000,000. and from \$2,000,000 to \$3,000,000., respectively.

NOW, THEREFORE, the parties hereto do mutually further agree as follows:


I. Item f. page 2 of Agreement for Local Cooperation at Hayward Creek Local Protection Project, Quincy/Braintree, Massachusetts, dated 20 May 1976, is deleted and the following is substituted therefor:

f. Assume full responsibility for all Project costs in excess of the Federal cost limitation of 3 million dollars.

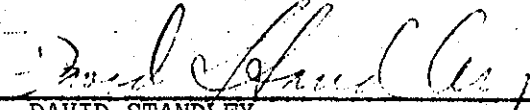
2. All other terms and conditions of the aforesaid Agreement dated 20 May 1976 are hereby ratified and, except as modified by this Supplemental Agreement, shall remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have hereunto subscribed their names as of the date first above written.

THE UNITED STATES OF AMERICA

By   
JOHN P. CHANDLER  
Colonel, Corps of Engineers  
Division Engineer  
Contracting Officer

THE COMMONWEALTH OF MASSACHUSETTS  
Department of Environmental  
Quality Engineering

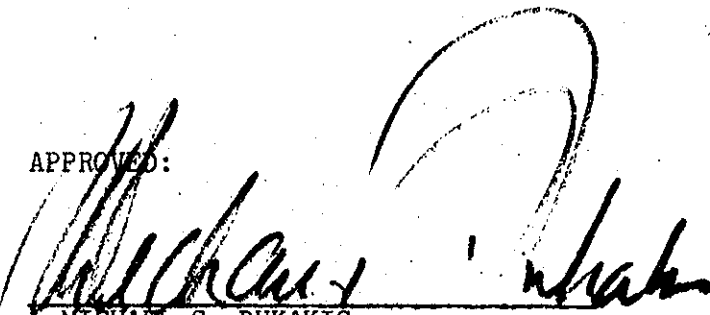
By   
DAVID STANDLEY  
Commissioner

APPROVED:

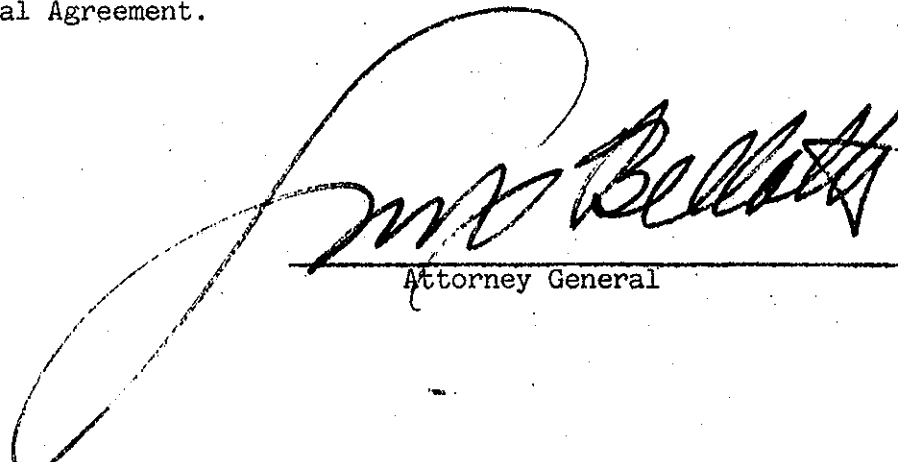
  
WOODROW BERGE  
Director of Real Estate

FOR THE Secretary of the Army

APPROVED:

  
MICHAEL S. DUKAKIS  
Governor

I have reviewed the foregoing Supplemental Agreement and have considered the effect of Section 221 of the Flood Control Act of 1970, Public Law 91-611, and I am satisfied that the Commonwealth can fully comply with the provisions of said Supplemental Agreement. Accordingly, I approve the foregoing Supplemental Agreement.

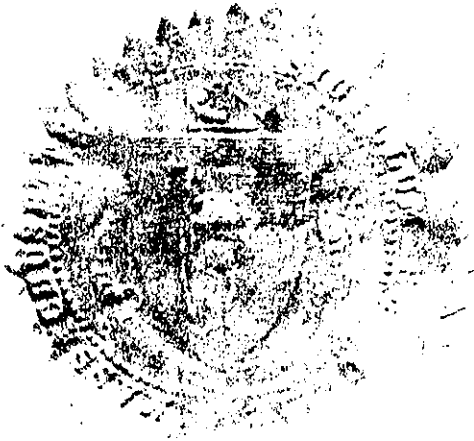
  
Attorney General



CERTIFICATION

I, Paul Guzzi, do hereby certify that I am Secretary of the Commonwealth; that David Standley, who signed this Agreement on behalf of the Commonwealth, was then the Commissioner of the Department of Environmental Quality Engineering; that said Agreement was duly signed for and on behalf of the Commonwealth; and that said Agreement is within the scope of the Commissioner's powers; and that Francis X. Bellotti was Attorney General at the time of his approval.

I further certify that Michael S. Dukakis was Governor of this Commonwealth on the date of approval of this Agreement.

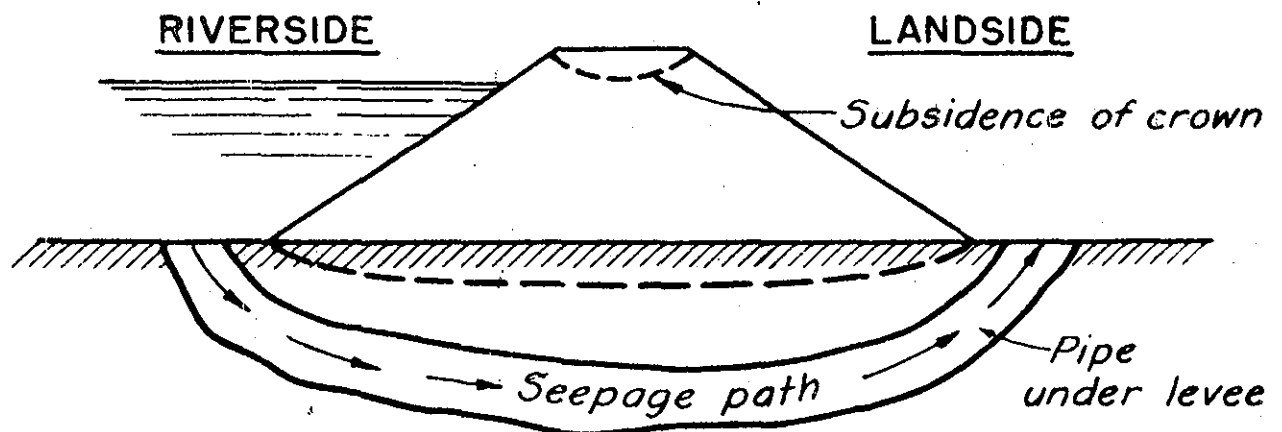


Paul Guzzi  
Secretary of the Commonwealth

APPENDIX E

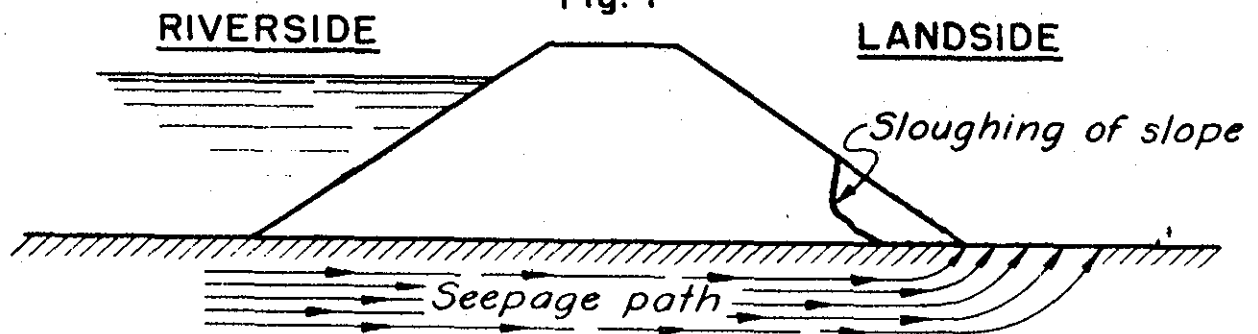
FLOOD EMERGENCY MEASURES

<u>Plate No.</u>	<u>Title</u>
I	Effect of Sand Boils
II	Sand Boil
III	Sacking Sloughs
IV	Sack Dike or Topping
V	Model Sack Dike or Topping
VI	Lumber and Sack Topping
VII	Flashboards



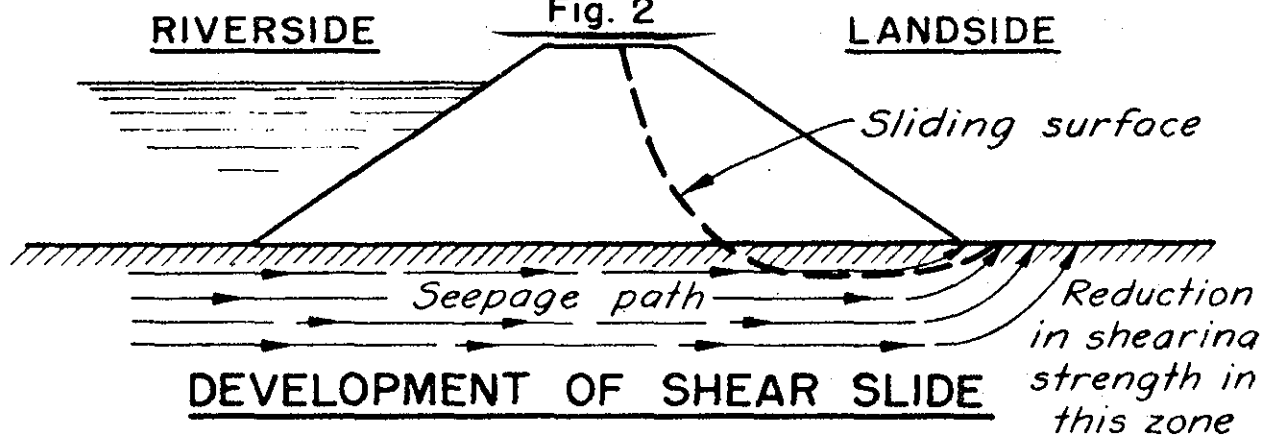
### DEVELOPMENT OF PIPE UNDER LEVEE

Fig. 1



### SLOUGHING OF LANDSLIDE SLOPE DUE TO RAVELLING AND UNDERCUTTING OF TOE

Fig. 2



### DEVELOPMENT OF SHEAR SLIDE

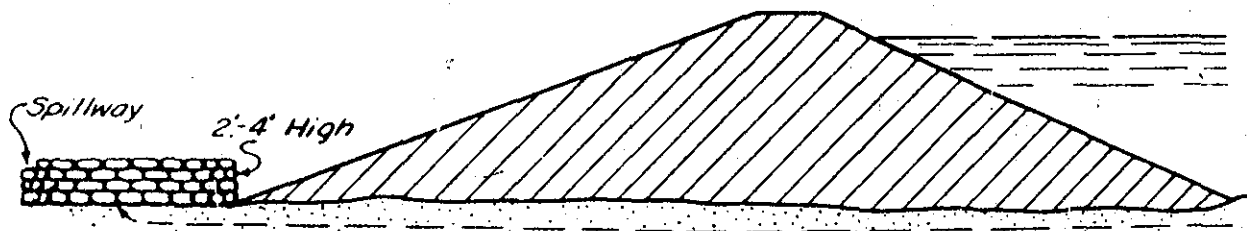
Fig. 3

### EFFECTS OF SAND BOILS ON LEVEE

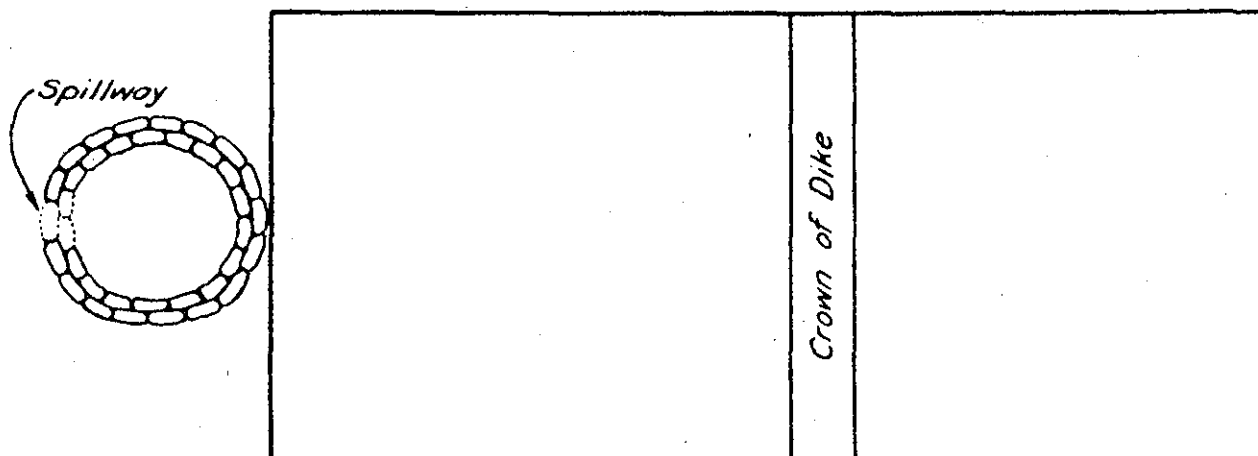
EMERGENCY PROCEDURE MANUAL  
FOR DISASTER RELIEF

( VOLUME II, PART I )

"FLOOD FIGHTING"



Wall should be built on firm ELEVATION  
 foundation, with width of base  
 at least  $1\frac{1}{2}$  times the height.  
 Be sure to place sacks on ground  
 clear of sand discharge.  
 Tie into dike if boil is near toe.

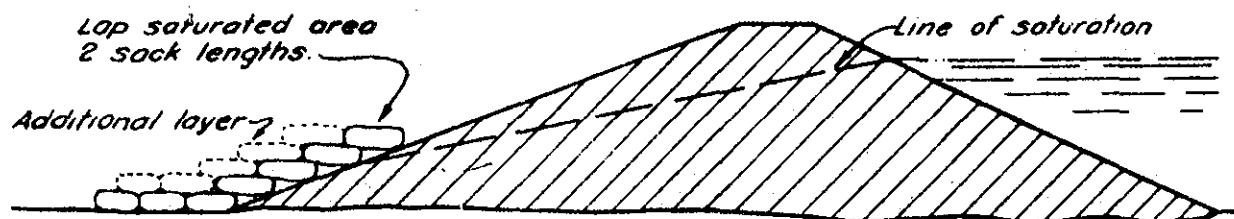


PLAN

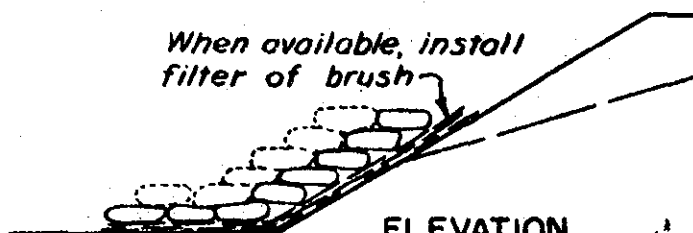
Do not sack boil which  
 does not put out material.  
 Height of sack loop or ring  
 should be only sufficient to  
 create enough head to slow  
 down flow through boil so  
 that no more material is dis-  
 placed and boil runs clear.  
 Do not try to stop fully, flow  
 through boil.

# SAND BOIL STANDARD HIGH WATER MAINTENANCE INSTRUCTION

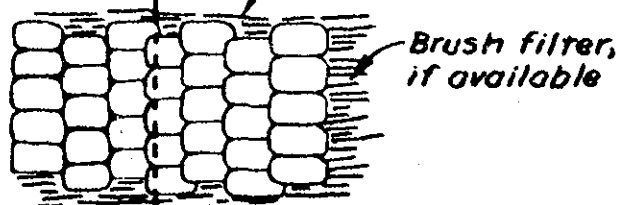
DEPARTMENT OF THE ARMY  
 NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
 WALTHAM, MASS.

ELEVATION

Number of layers determined by velocity of seepage and amount of material being carried

ELEVATION

Lap saturated area 2 sack widths on both ends.



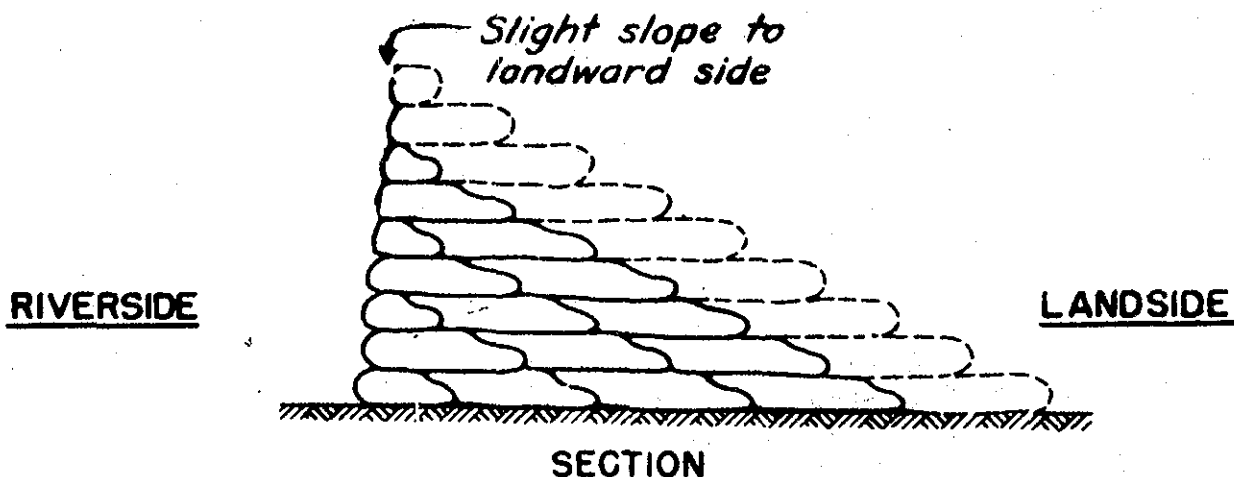
Crown of Dike

PLAN

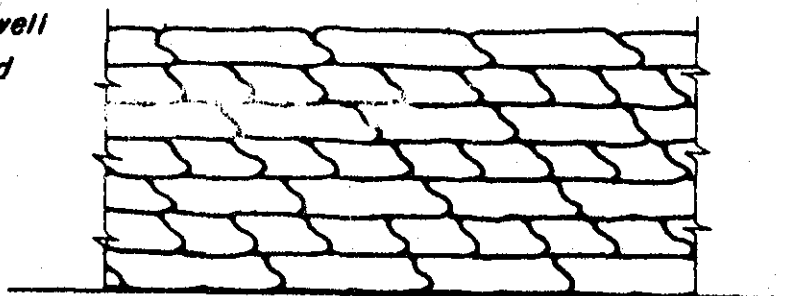
Sacks should be laid shingle fashion and not matted into place.

# SACKING SLOUGHS STANDARD HIGH WATER MAINTENANCE INSTRUCTION

DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
WALTHAM, MASS.



*Note: Sacks should be lapped at least 1/3 all ways and well mauled or tamped into place.*



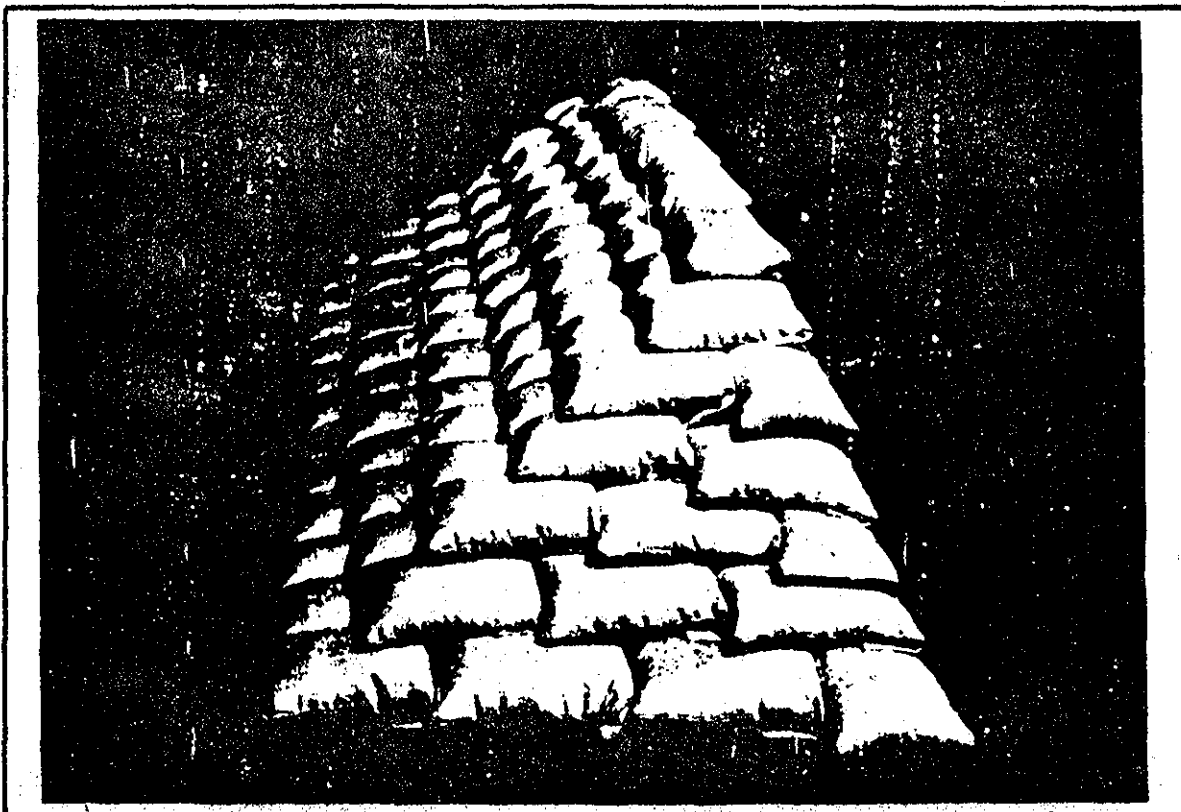
### RIVERSIDE ELEVATION

SACKS REQUIRED PER 100' STA.  
100 lb. "Feed" Sacks - 1 Cu. Ft. Each

Approx. Hgt. Sack Dike	Sacks High	Required
1.5	3	300
2.0	4	750
3.0	6	1400
4.0	8	2250
5.0	10	3250
6.0	12	4500
7.0	14	5950
8.0	16	7600

SACK DIKE OR TOPPING  
STANDARD HIGH WATER  
MAINTENANCE INSTRUCTION

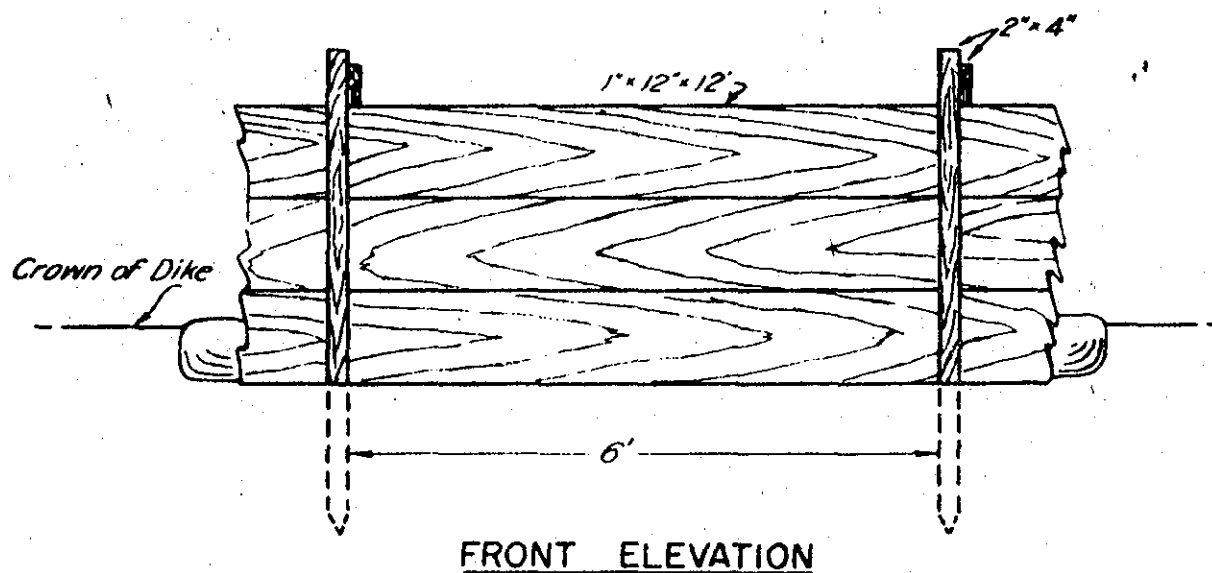
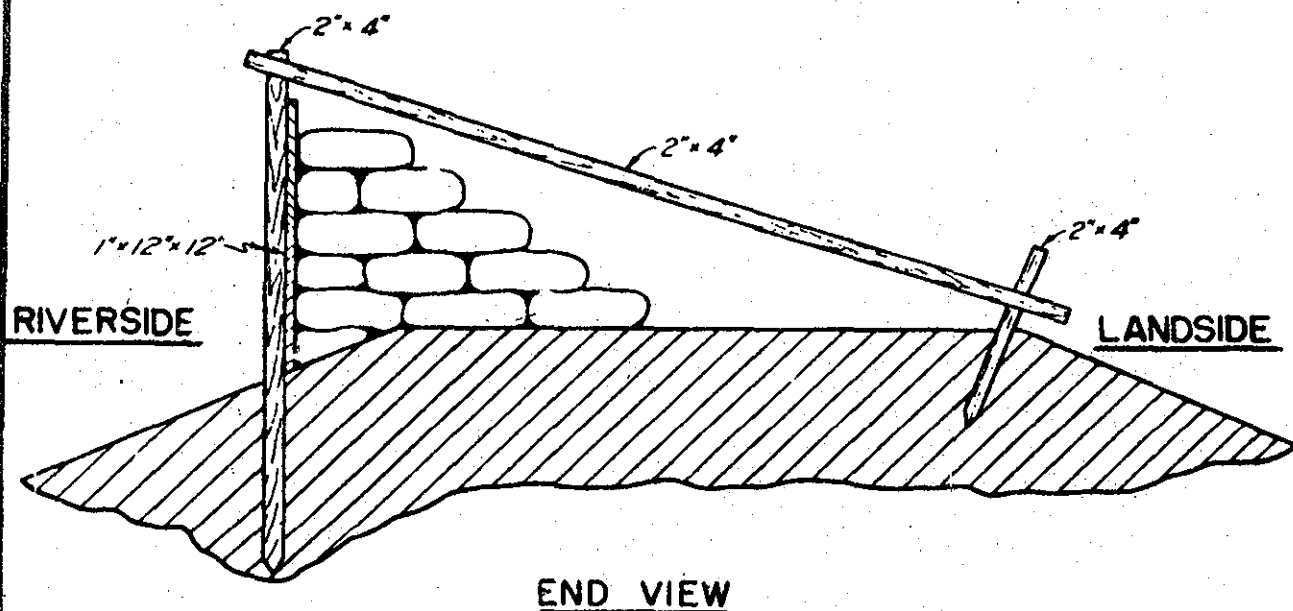
DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
WALTHAM, MASS.



MODEL SACK DIKE OR TOPPING  
Typical Section



MODEL SACK DIKE OR TOPPING  
Riverside View



**BILL OF MATERIAL TO CONSTRUCT 100 FEET**

25 pcs. 1" x 12" x 12'

17 pcs. 2" x 4" x 6'

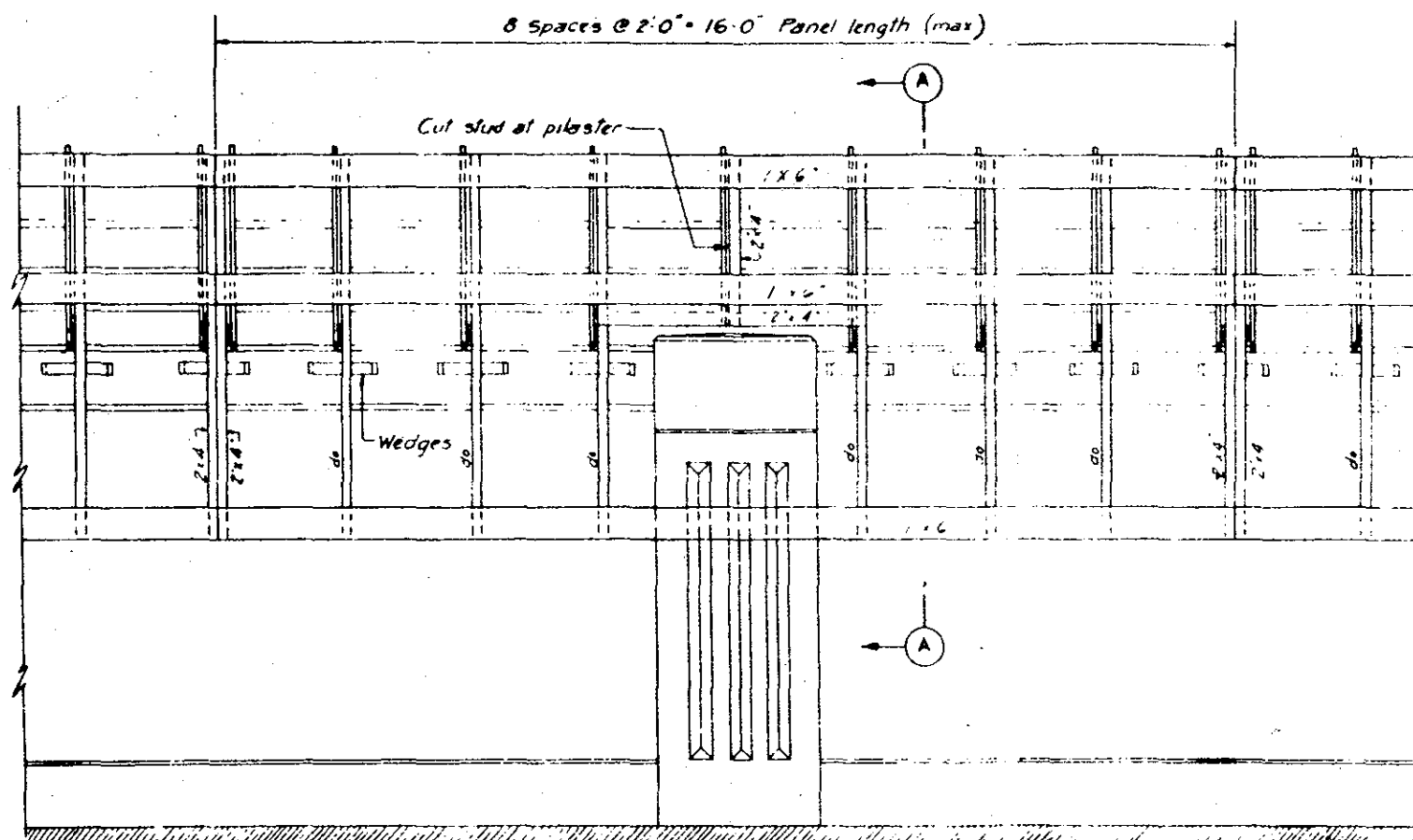
17 pcs. 2" x 4" x 10'

17 pcs. 2" x 4" x 2'

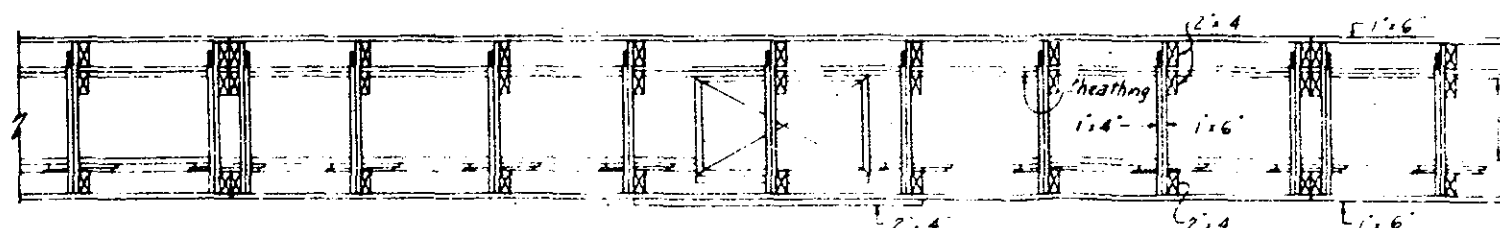
**LUMBER AND SACK TOPPING  
STANDARD HIGH WATER  
MAINTENANCE INSTRUCTION**

DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
WALTHAM, MASS.



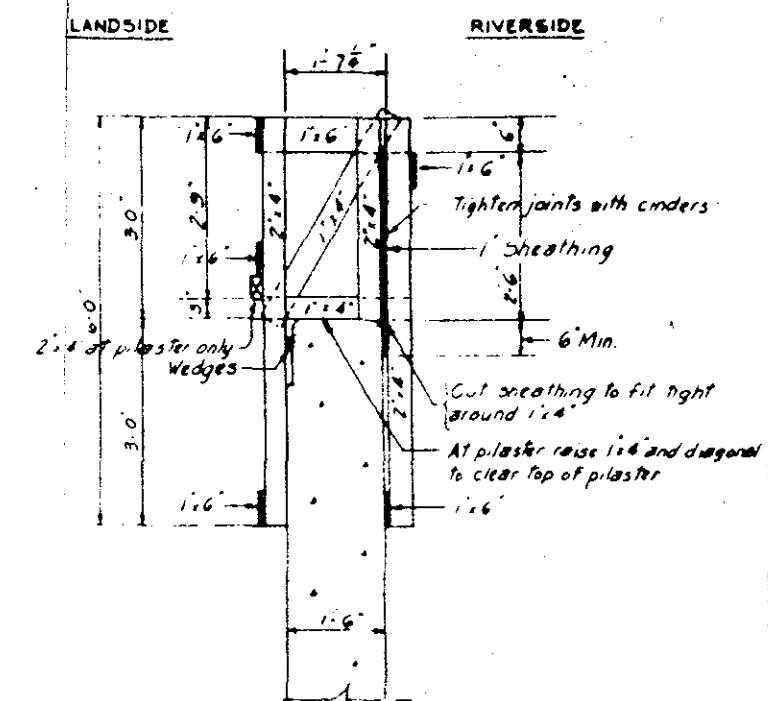


LANDSIDE ELEVATION

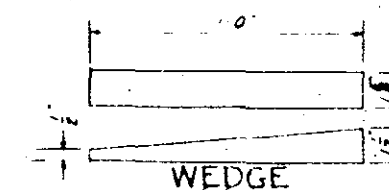


PLAN

BILL OF MATERIALS		
For one 8'-0" panel Regular wall section		
Uprights	10 pcs	2" x 4" x 6'-0"
Vert. brace	5"	2" x 4" x 3'-0"
Stringers	5"	1" x 6" x 8'-0"
Upper ties	5"	1" x 6" x 2'-3"
Lower ties	5"	1" x 4" x 2'-3"
Diagonals	5"	1" x 4" x 3'-6"
Sheathing	6"	1" x 6" x 8'-0" or random widths to make up 36'
Wedges	8	(1/2 to 1 1/2) x 2" x 0" x 1'3" x 4'-0"
For one 8'-0" panel Pilaster section		
Same as above list except		
Substitute one upright 2" x 4" x 2'-9" for one 2" x 4" x 6'-0"		
Add one stringer piece 2" x 4" x 4'-2"		



SECTION A-A



DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION  
CORPS OF ENGINEERS  
WALTHAM, MASS.

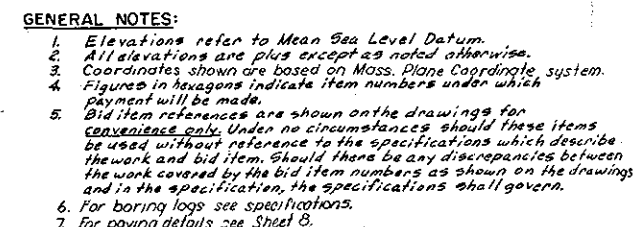
## EMERGENCY FLASH BOARDS FOR FLOOD WALLS

DATE:

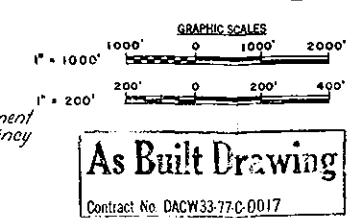
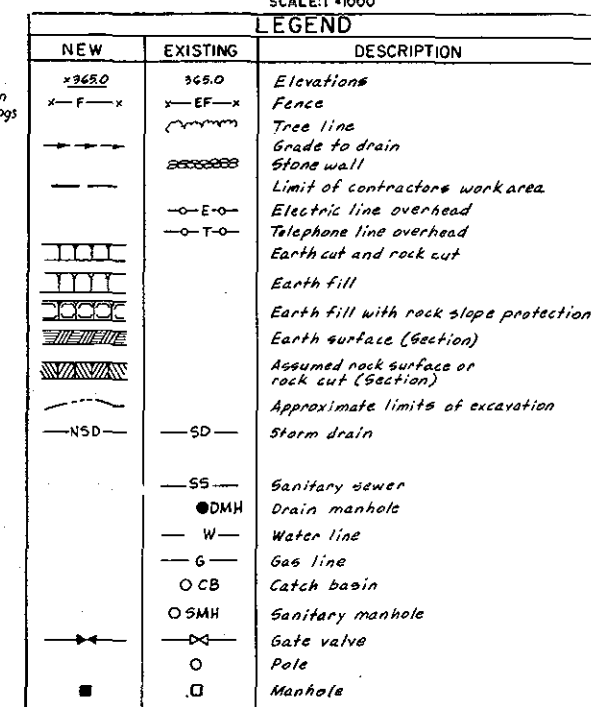
PLATE NO. VII

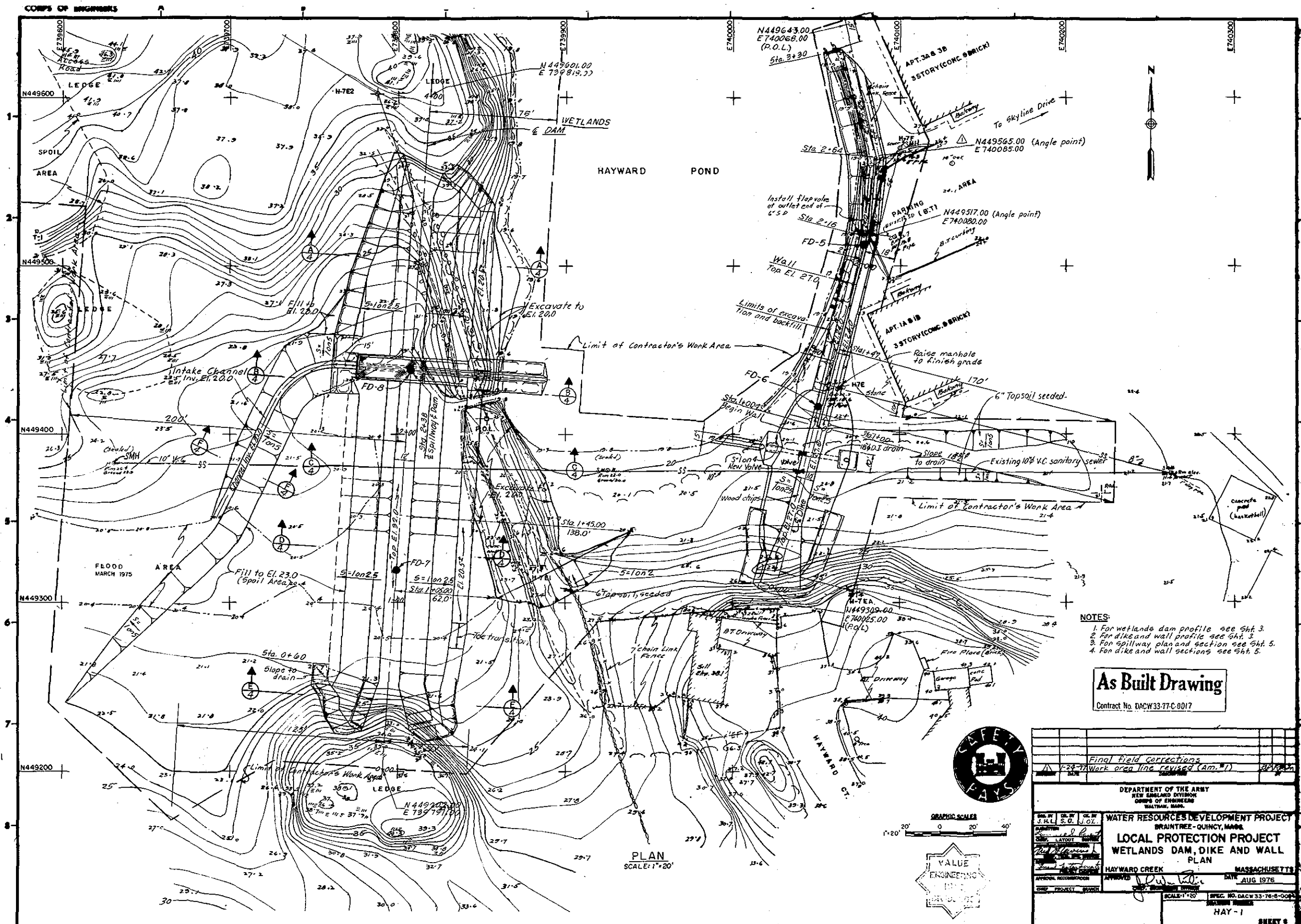
APPENDIX F

AS-BUILT DRAWINGS



DRAWINGS INCLUDED WITH SPECIFICATIONS		
DWG NO.	SH NO.	TITLE
STD - 36	1	SAFETY SIGN
STD - 22A	1	CONSTRUCTION PROJECT SIGN
SK - 257		MATERIALS LABORATORY AT HAYWARD CREEK
40-02-03		WATERSTOPS - TYPES U AND Y
STD-3		STANDARD STRUCTURAL JOINT DETAILS
NEW ENGLAND DIVISION STANDARD DRAWINGS		
DWG NO.	SH NO.	TITLE
STD - 4	1	1 AND 2 NUMBER TILE AND STAFF GAGES-ELEVATIONS, SECTIONS AND





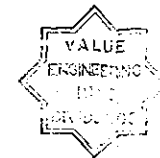
- NOTES:
- 1. For wetlands dam profile see Sht. 3.
  - 2. For dike and wall profile see Sht. 3.
  - 3. For spillway plan and section see Sht. 5.
  - 4. For dike and wall sections see Sht. 5.

**As Built Drawing**

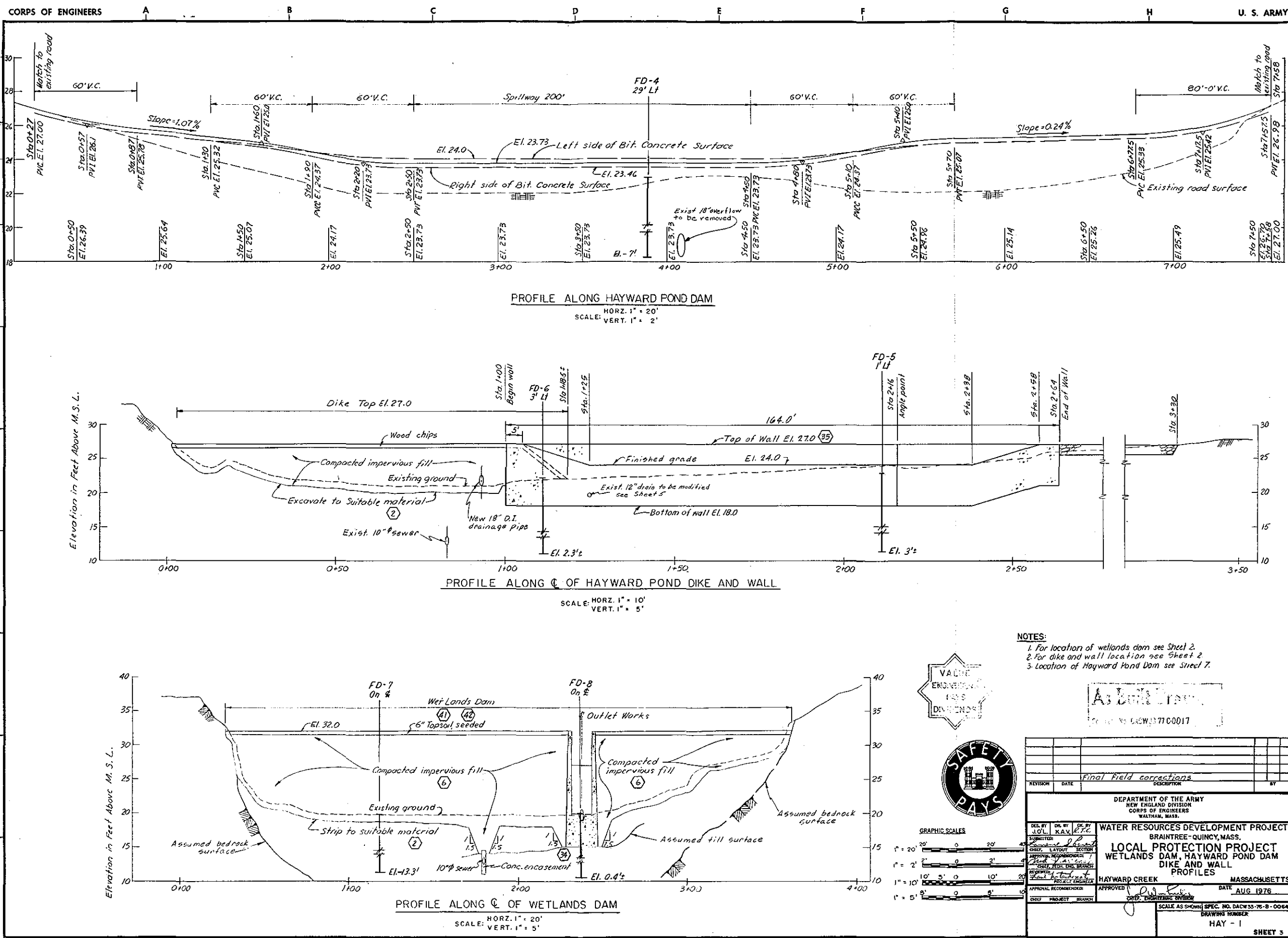
Contract No. DACW33-77-C-0017



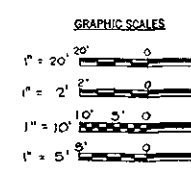
GRAPHIC SCALE  
1"=20'



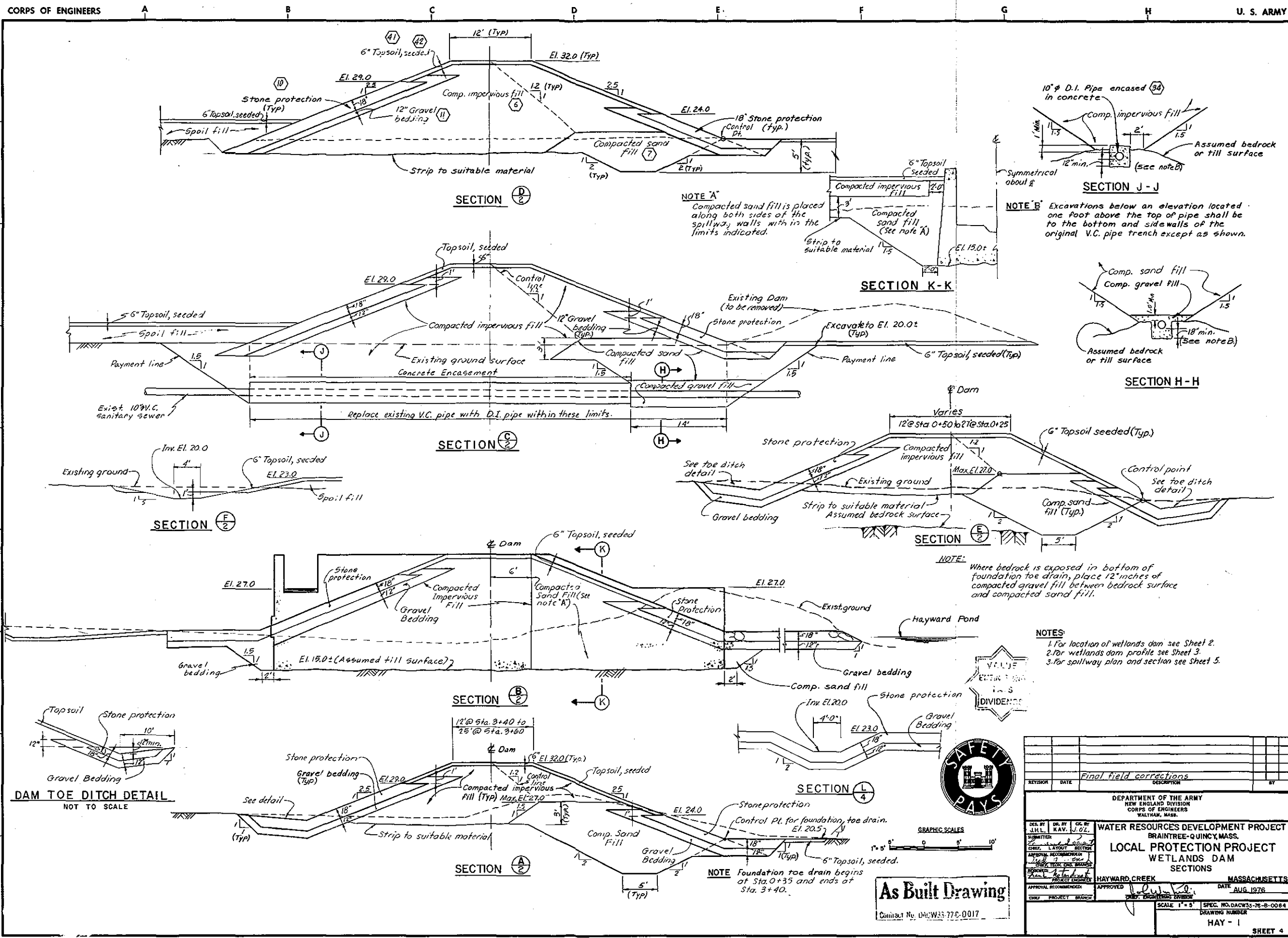
Final Field Corrections +24.74 Work area line revised (Am. #1)			
DEPARTMENT OF THE ARMY NEW ENGLAND DIVISION CORPS OF ENGINEERS WALTHAM, MASS.			
WATER RESOURCES DEVELOPMENT PROJECT BRAINTREE-QUINCY, MASS.			
LOCAL PROTECTION PROJECT WETLANDS DAM, DIKE AND WALL PLAN			
HAYWARD CREEK		MASSACHUSETTS	
APPROVED: [Signature]		DATE: AUG 1976	
SPEC. NO. DACW33-76-8-0004		SCALE: 1"=20'	
HAY-1		SHEET 6	



- NOTES:**
1. For location of wetlands dam see Sheet 2.
  2. For dike and wall location see Sheet 2.
  3. Location of Hayward Pond Dam see Sheet 7.



REVISION		DATE	DESCRIPTION	BY
			Final field corrections	
DEPARTMENT OF THE ARMY NEW ENGLAND DIVISION CORPS OF ENGINEERS WALTHAM, MASS.				
WATER RESOURCES DEVELOPMENT PROJECT BRAintree - QUINCY, MASS.				
LOCAL PROTECTION PROJECT WETLANDS DAM, HAYWARD POND DAM DIKE AND WALL PROFILES				
HAYWARD CREEK		MASSACHUSETTS		
APPROVAL RECOMMENDED		APPROVED		
CHIEF PROJECT BRANCH		CHIEF ENGINEERING DIVISION		
SCALE AS SHOWN		SPEC. NO. DACW 33-75-8-0064		
DRAWING NUMBER		HAY - 1		
		SHEET 3		

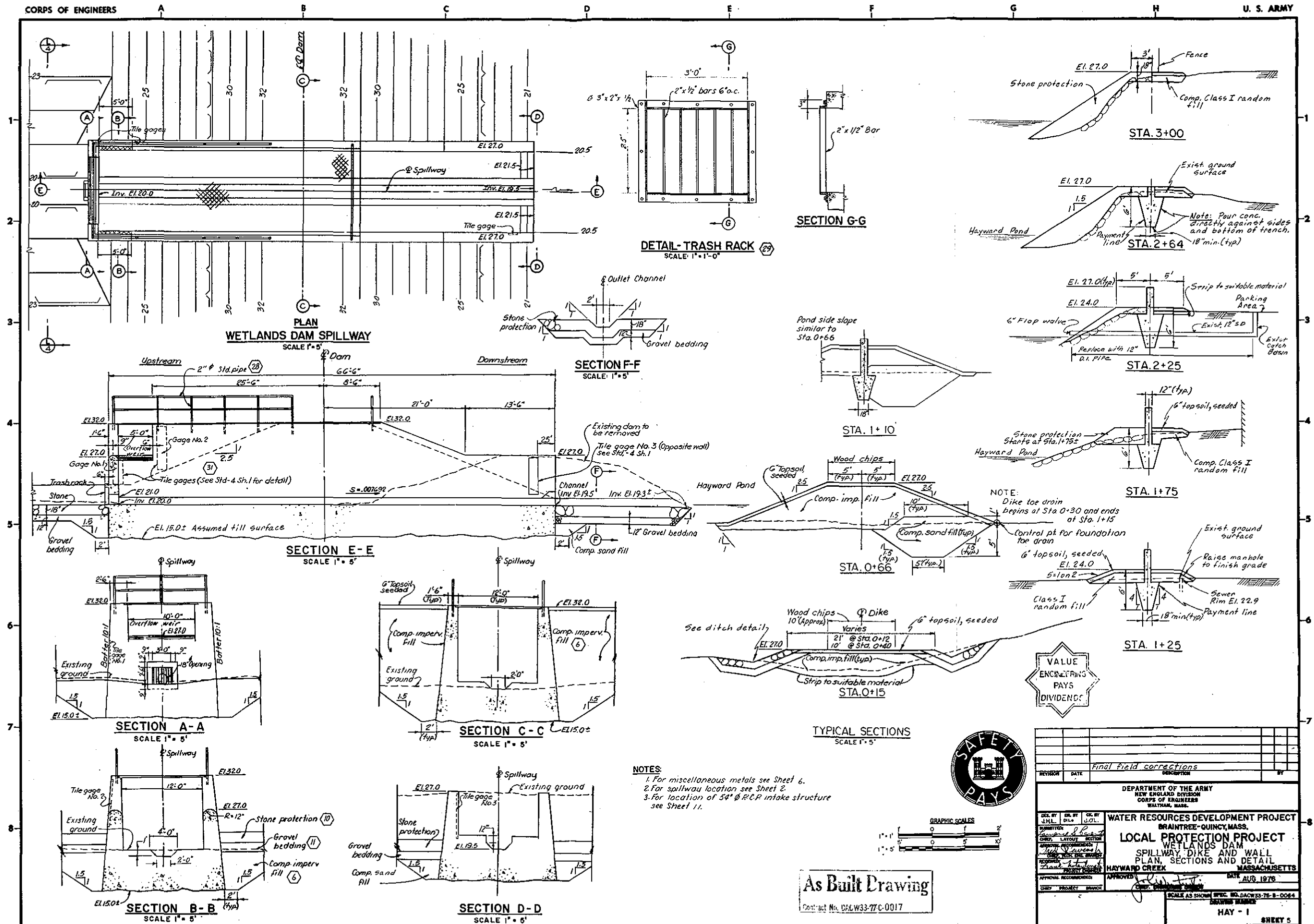


DAM TOE DITCH DETAIL  
NOT TO SCALE

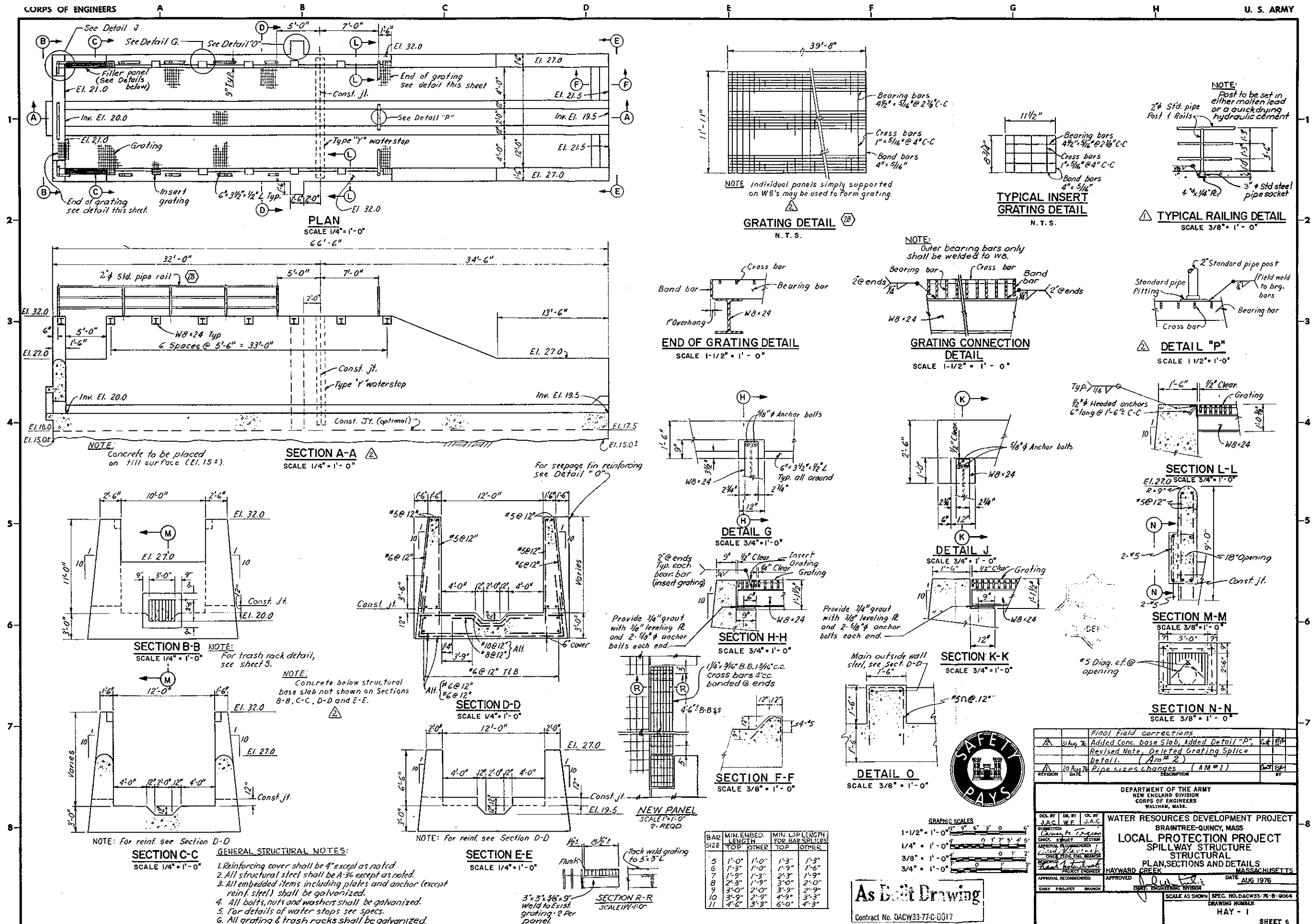
As Built Drawing  
Contract No. DACW33-77C-0017



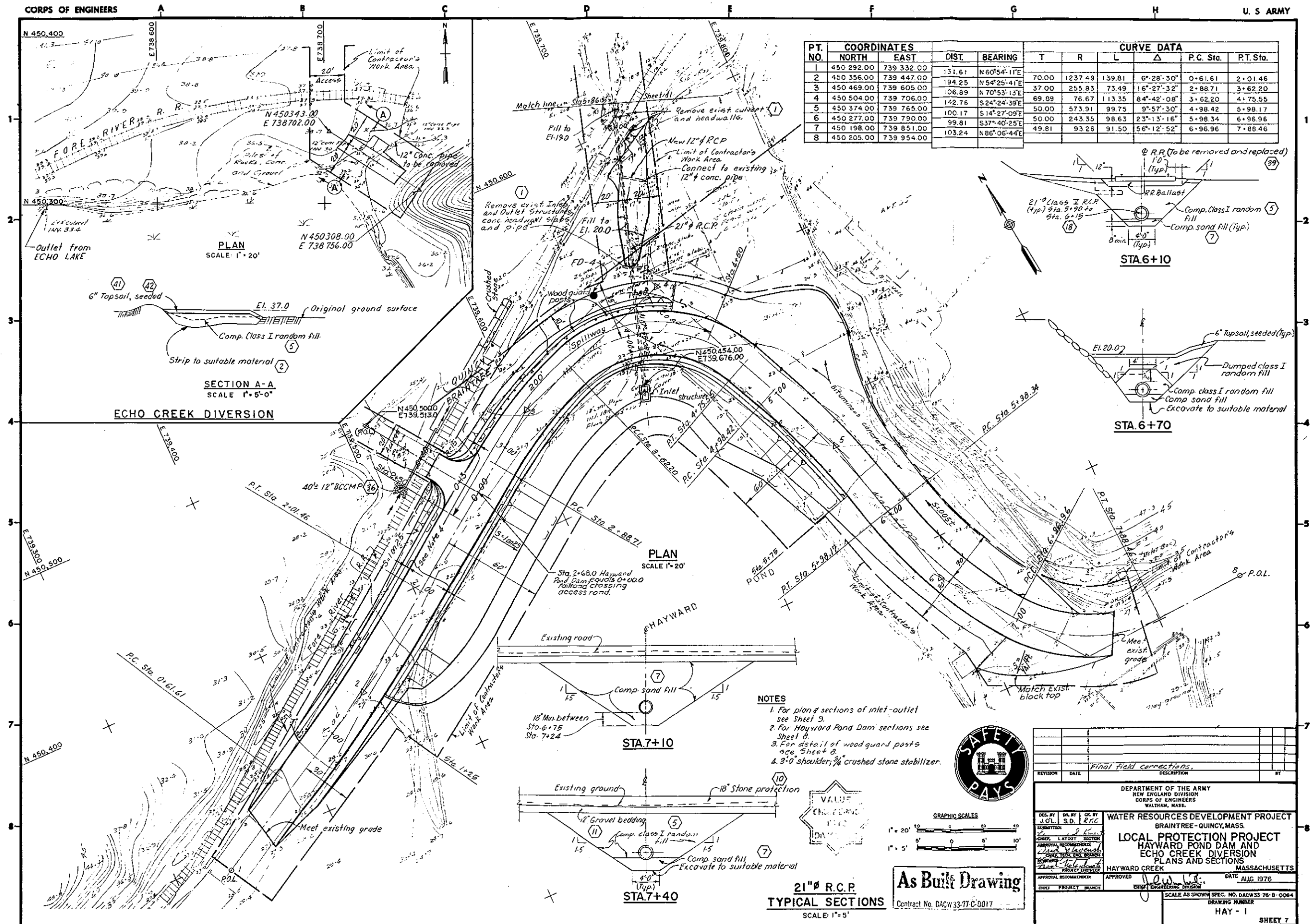
Final field corrections			
REVISION	DATE	DESCRIPTION	BY
DEPARTMENT OF THE ARMY NEW ENGLAND DIVISION CORPS OF ENGINEERS WALTHAM, MASS.			
WATER RESOURCES DEVELOPMENT PROJECT BRAINTREE-QUINCY, MASS.			
LOCAL PROTECTION PROJECT WETLANDS DAM SECTIONS			
HAYWARD CREEK MASSACHUSETTS			
DATE AUG 1976			
SCALE 1" = 5'			
SPEC. NO. DACW33-76-B-0084			
DRAWING NUMBER HAY - I			
SHEET 4			

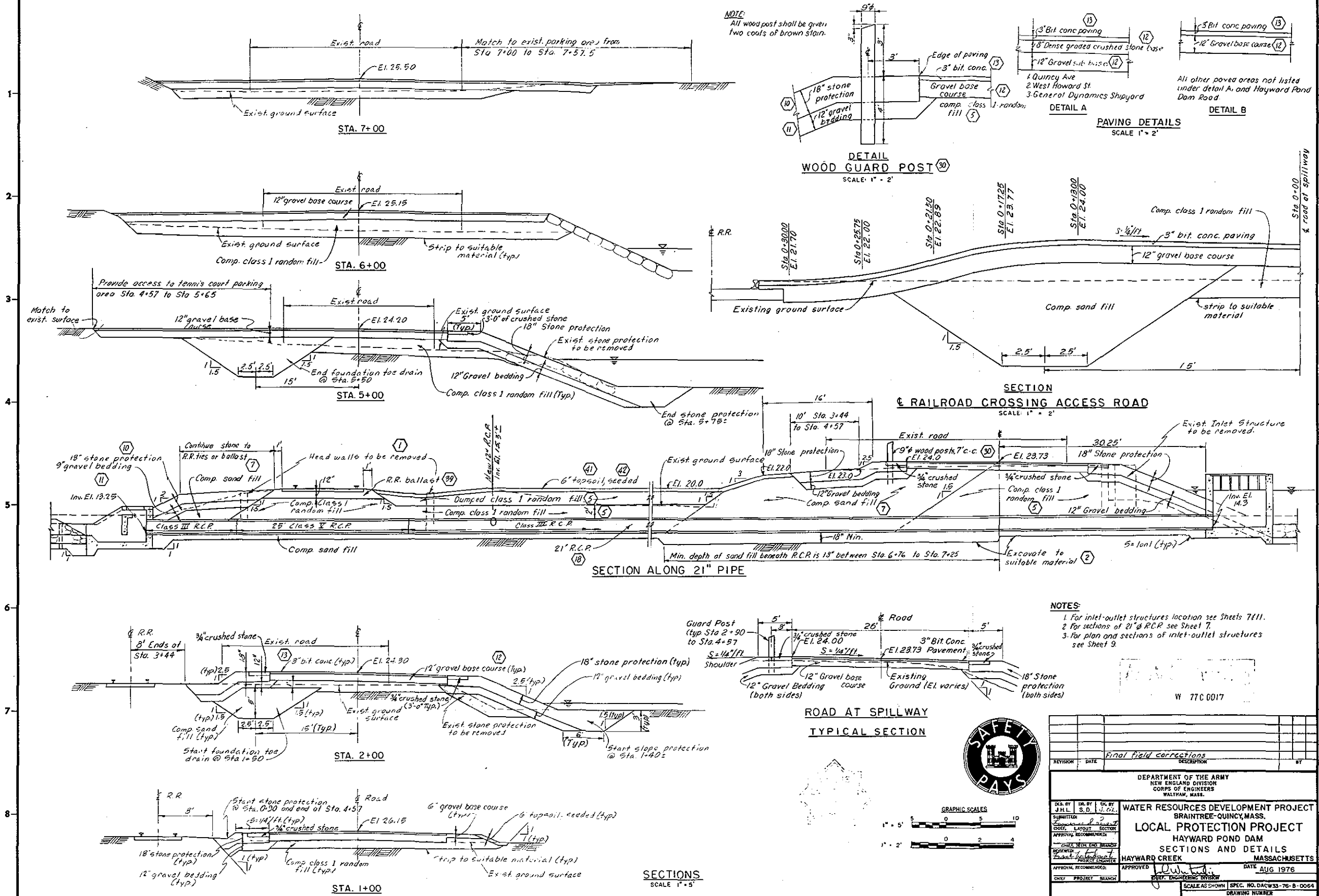


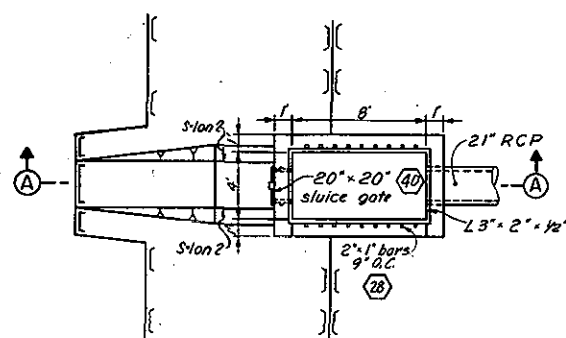




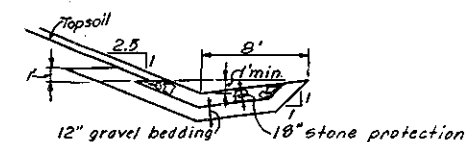






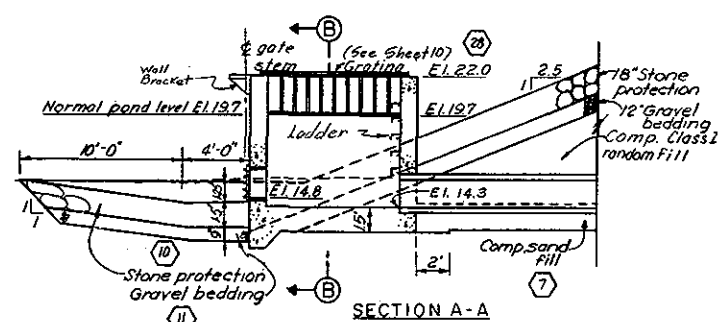


PLAN

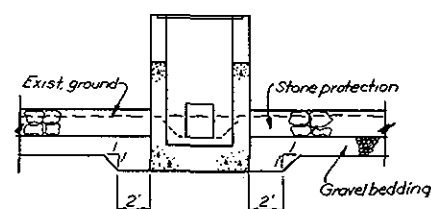


DIKE TOE DITCH DETAIL

STA. 0+00 TO 0+45 - WATERSIDE  
STA. 0+12 TO 0+55 - LANDSIDE  
SCALE: 1" = 5'

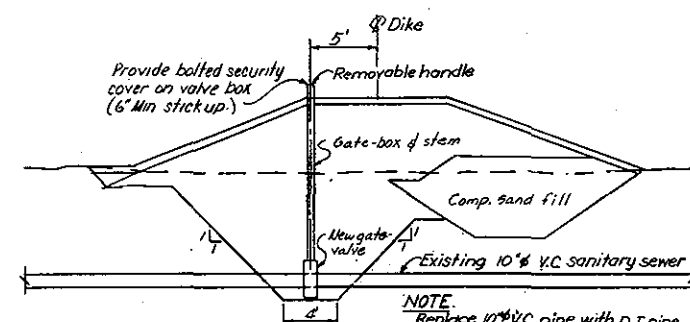


SECTION A-A



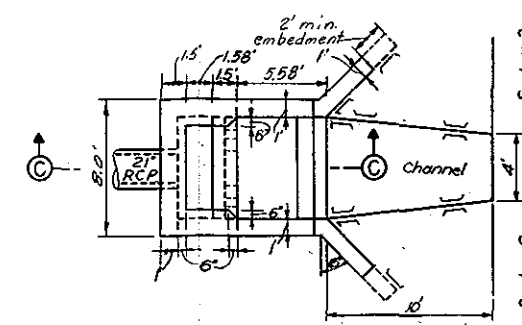
SECTION B-B

21" R.C.P  
INLET STRUCTURE  
SCALE: 1" = 4'

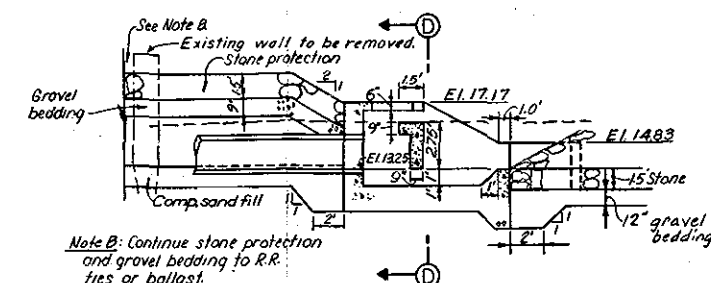


SECTION THRU EXISTING 10" V.C. SANITARY SEWER  
NOT TO SCALE

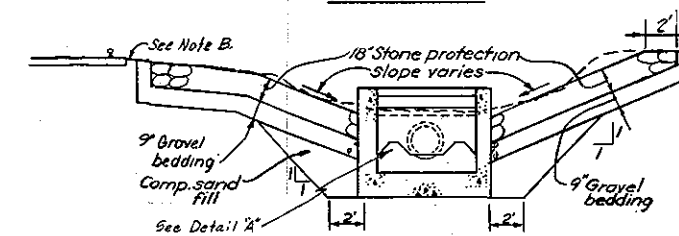
NOTE.  
Replace 10" PVC pipe with D.T.



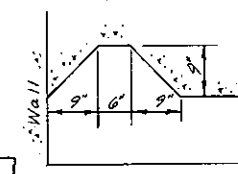
PLAN



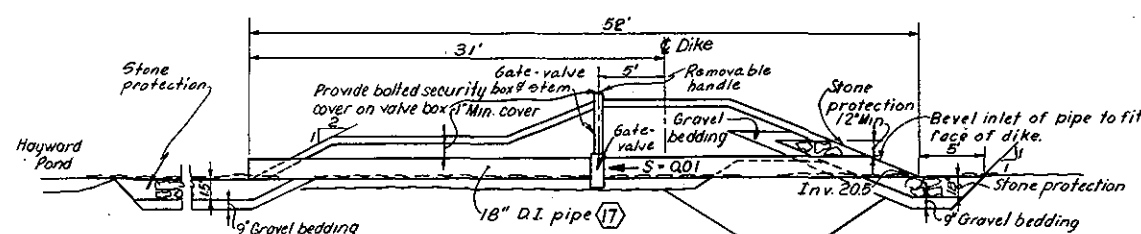
SECTION C-C



SECTION D-D  
21" R.C.P.  
OUTLET STRUCTURE  
SCALE: 1" = 4'



DETAIL "A"  
SCALE: 1" = 1'-0"

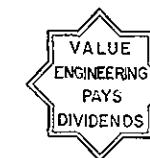


SECTION THRU 18" D.I. DRAINAGE PIPE  
NOT TO SCALE

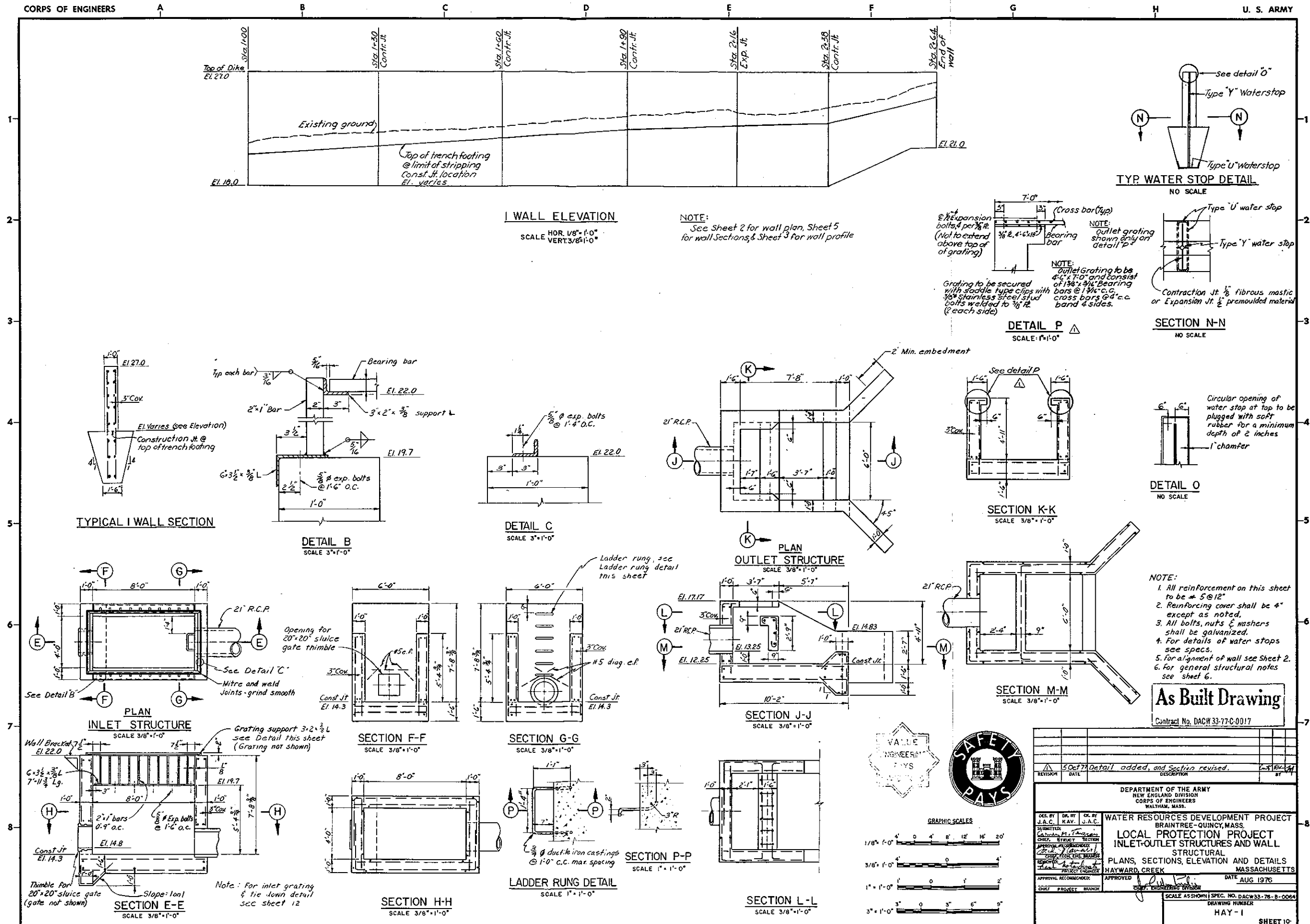
**NOTES:**

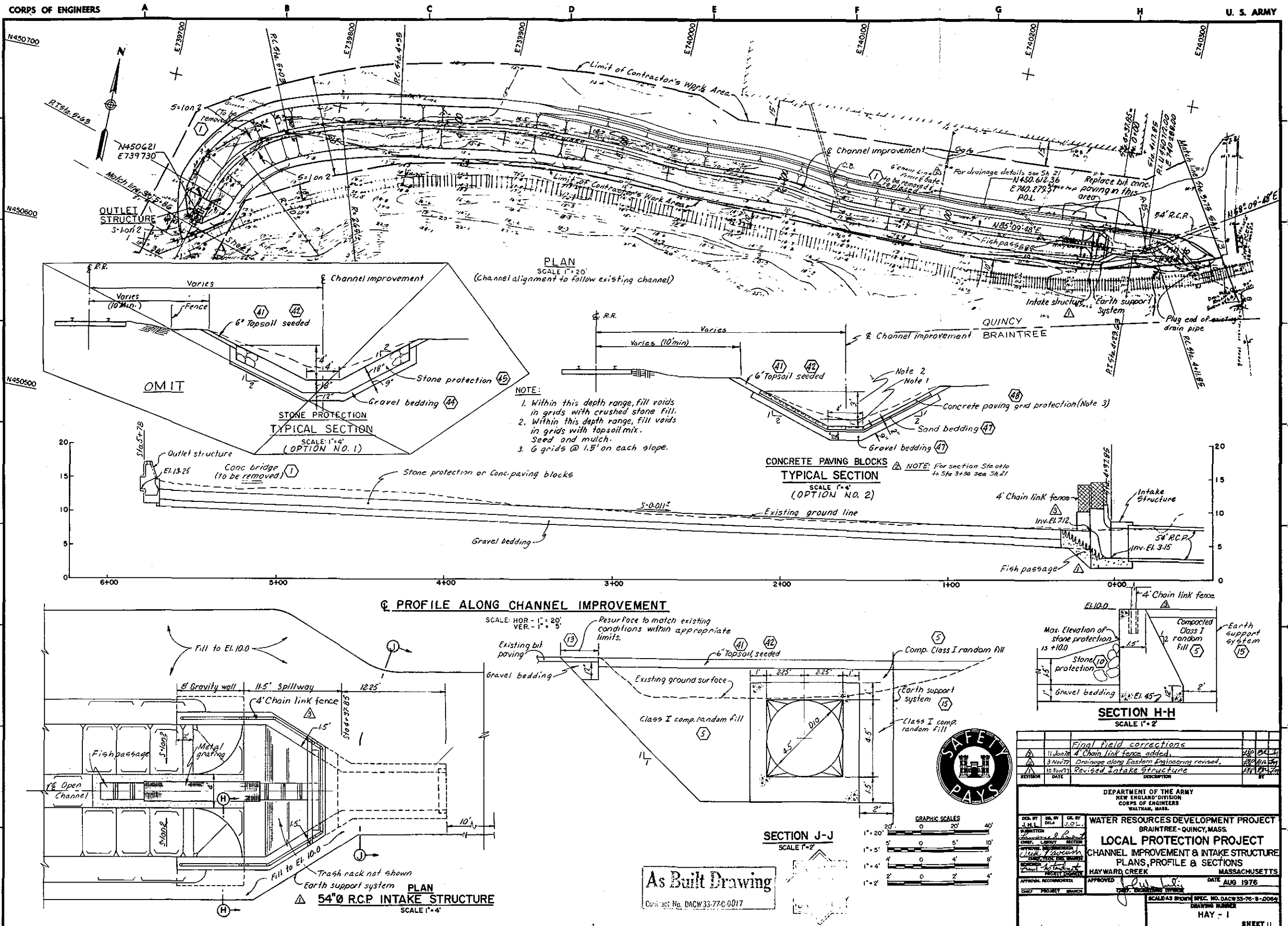
- NOTES:
1. For miscellaneous metals see Sheet 6.
  2. For dike and wall profile see Sheet 3.
  3. For inlet-outlet structures location see Sheet 7 & 11.

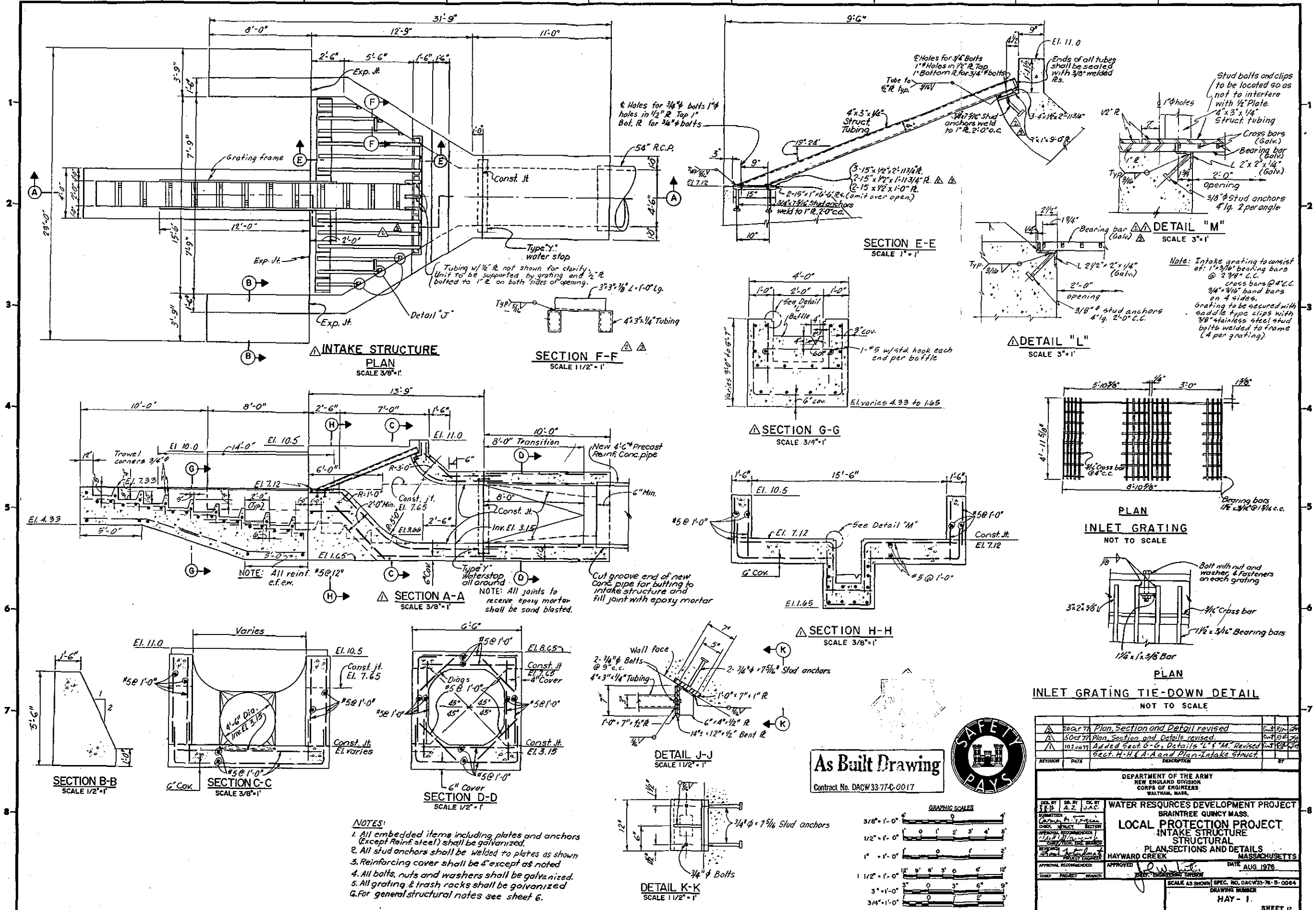
**As Built Drawing**  
Contract No. DACW 33-77-C-0017



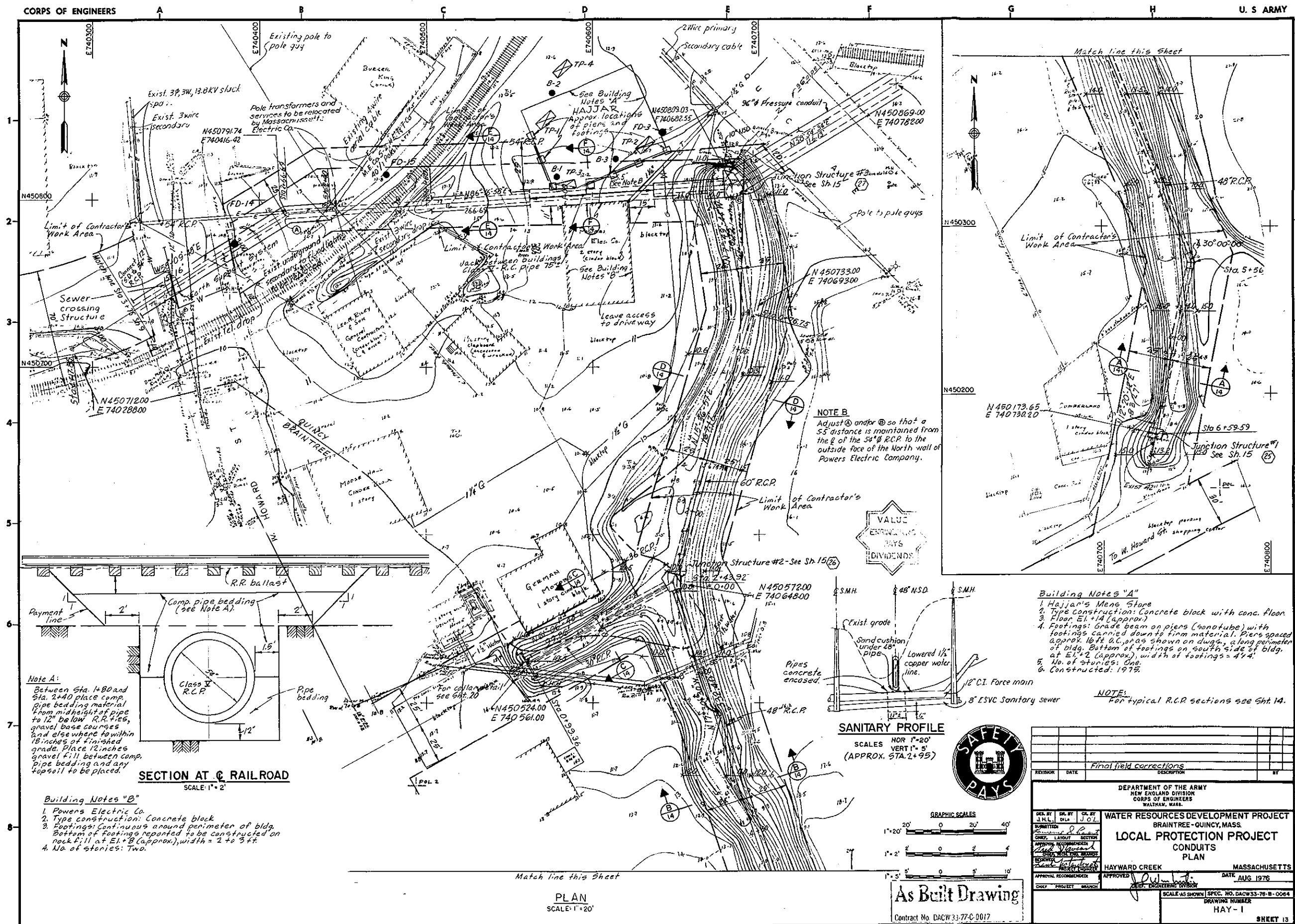
REVISION			DATE			DESCRIPTION			BY		
<p align="center"><b>DEPARTMENT OF THE ARMY</b>  <b>NEW ENGLAND DIVISION</b>  <b>CORPS OF ENGINEERS.</b>  <b>WALTHAM, MASS.</b></p>											
DES. BY U. S. E. L.	DES. BY U. S. E. L.	CH. BY U. S. E. L.	<p align="center"><b>WATER RESOURCES DEVELOPMENT PROJECT</b>  <b>BRAINTREE-QUINCY, MASS.</b>  <b>LOCAL PROTECTION FLOOD</b>  <b>HAVERDALE POND DAM</b>  <b>INLET-OUTLET STRUCTURES</b>  <b>PLANS AND SECTIONS</b></p>								
SUBMITTER <i>James J. Quinn</i>	DESIGN LAYOUT <i>James J. Quinn</i>	APPROVAL RECOMMENDED <i>James J. Quinn</i>	<p align="center"><b>HAVERDALE CREEK</b>      <b>MASSACHUSETTS</b></p>								
APPROVAL <i>James J. Quinn</i>	PROJECT ENGINEER <i>James J. Quinn</i>	APPROVED <i>James J. Quinn</i>	<p align="center">DATE <b>AUG 1978</b></p>								
ONLY PROJECT SEARCH	<p align="center">SCALE AS SHOWN SPEC. NO. DAC733-78-B-008A  <b>DRAWING NUMBER</b>  <b>MAY - 1</b>      <b>SHEET</b></p>										







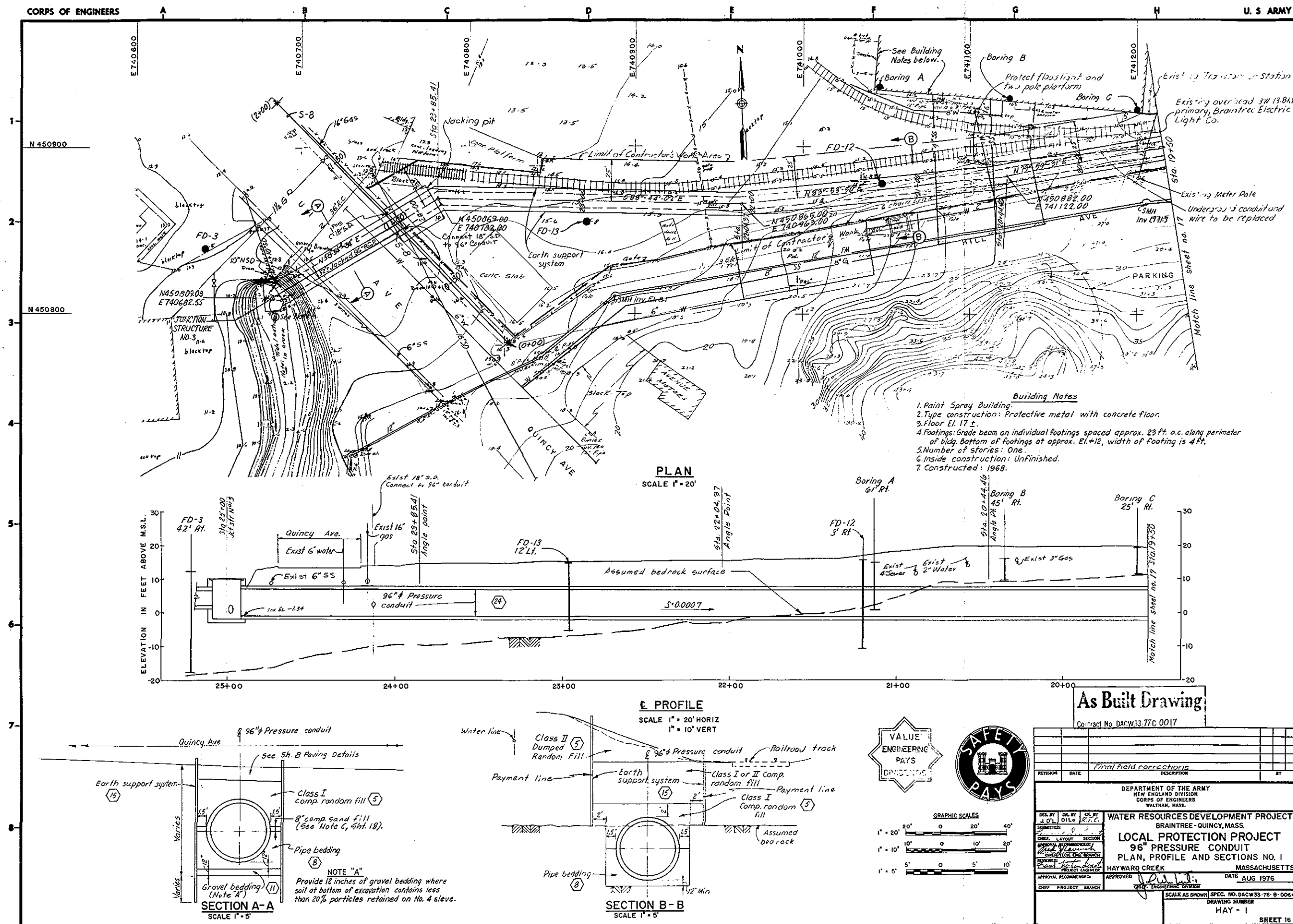


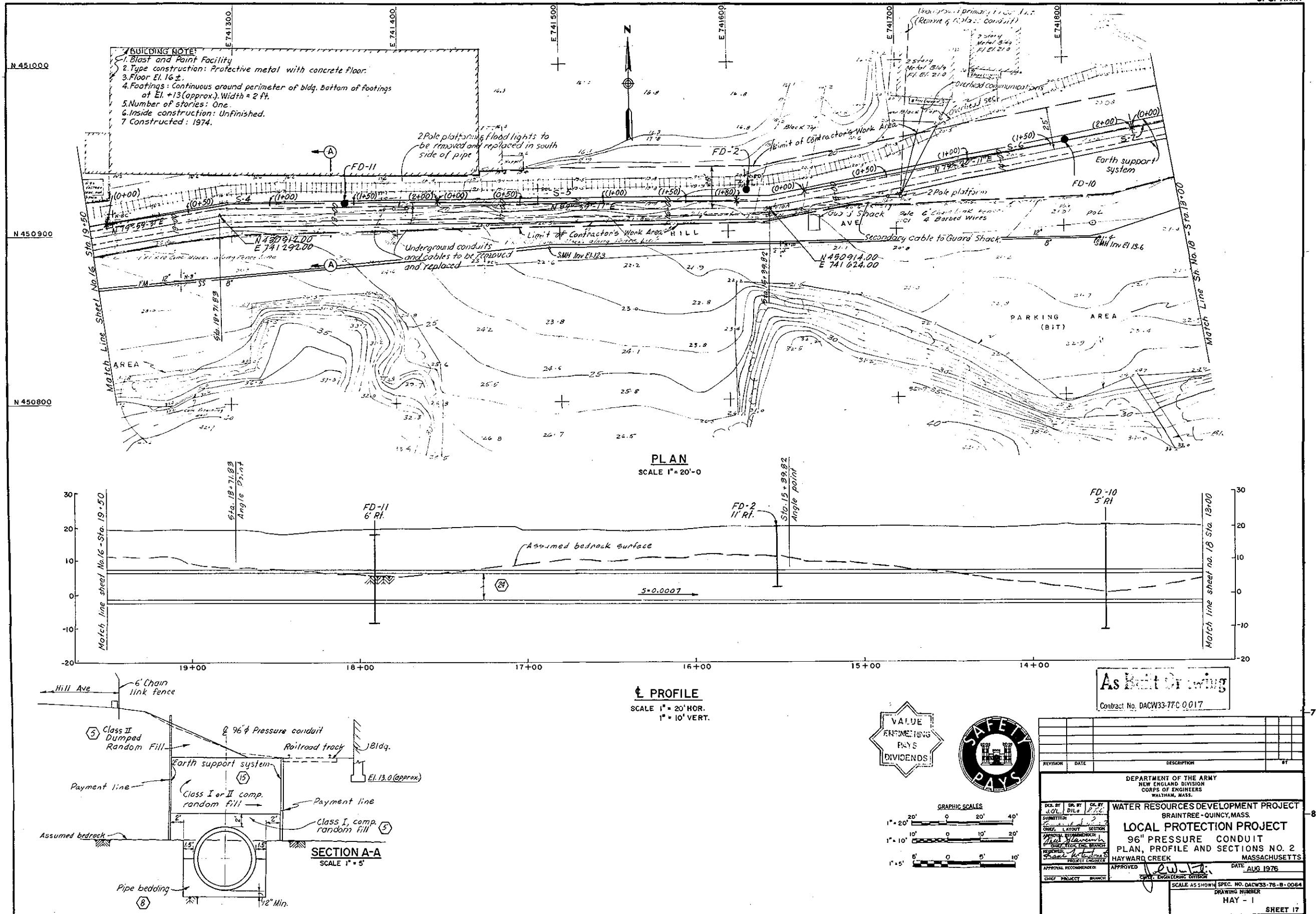


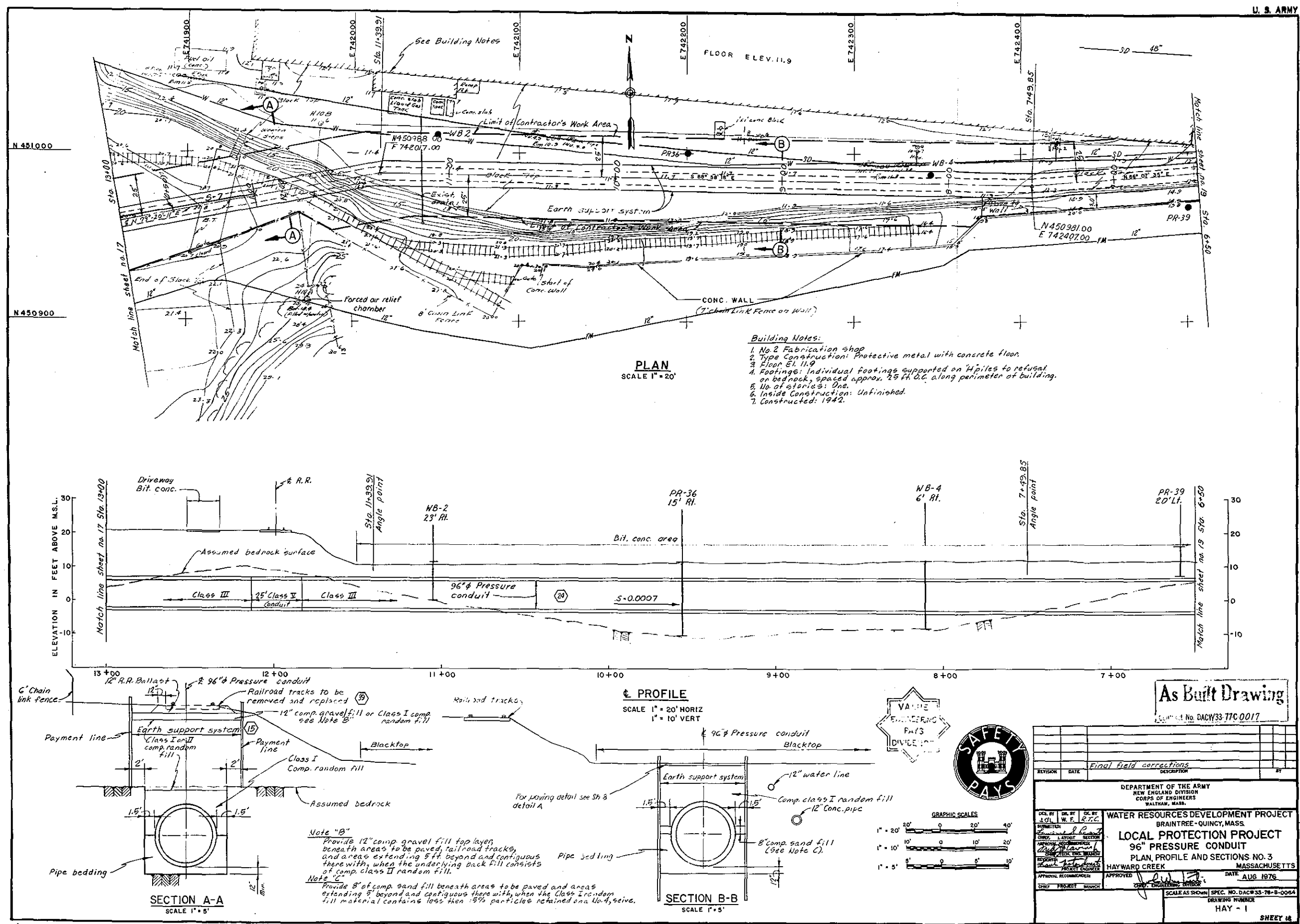


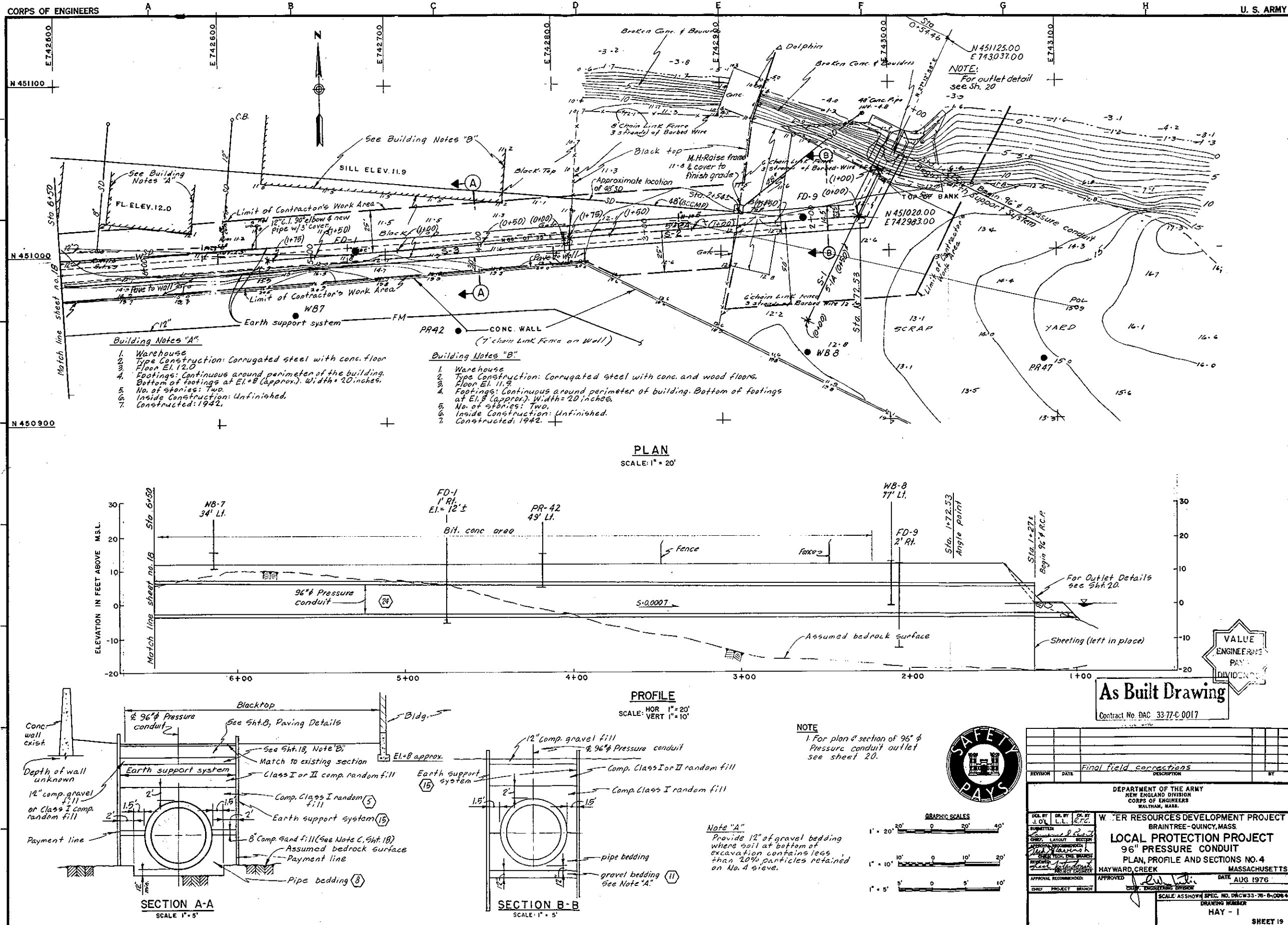


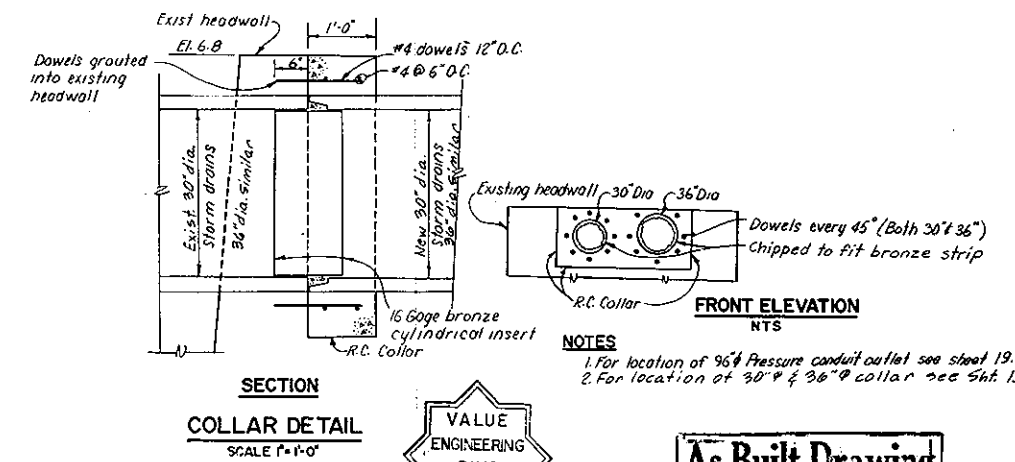
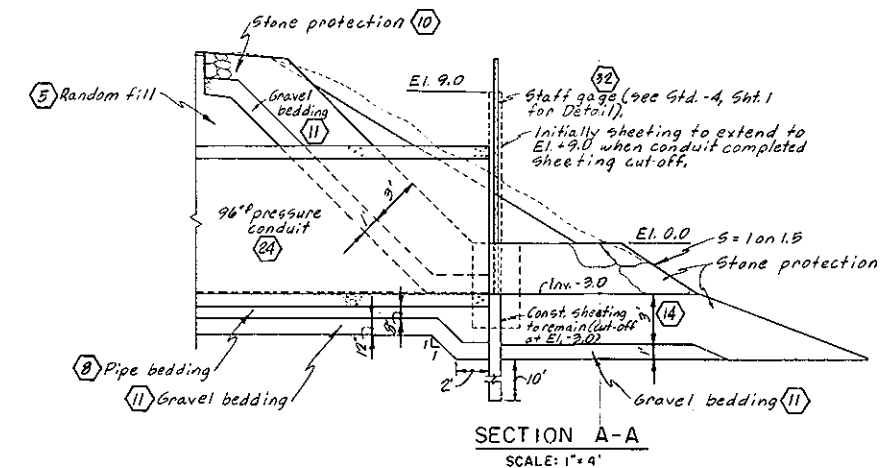












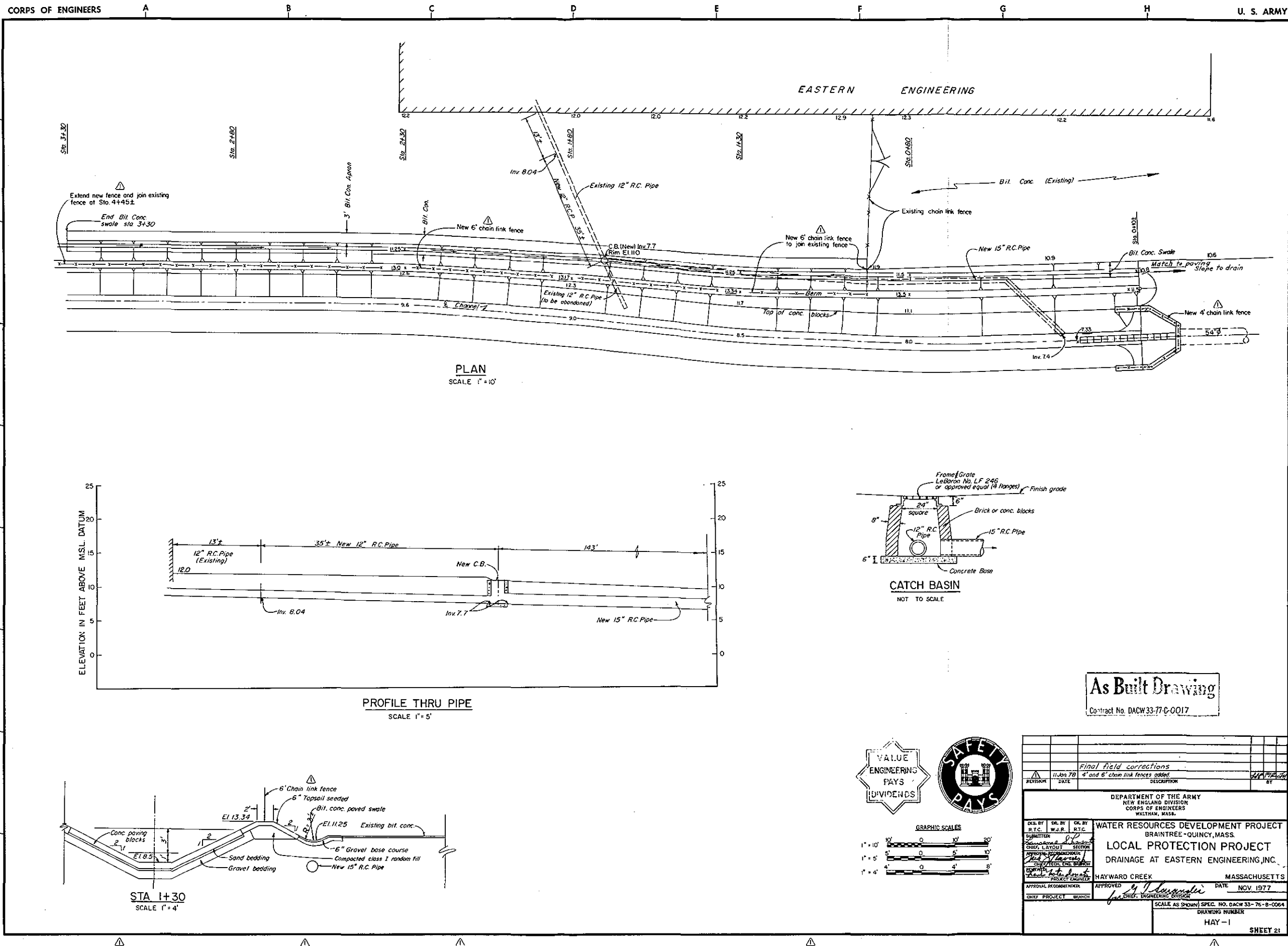
**NOTES**

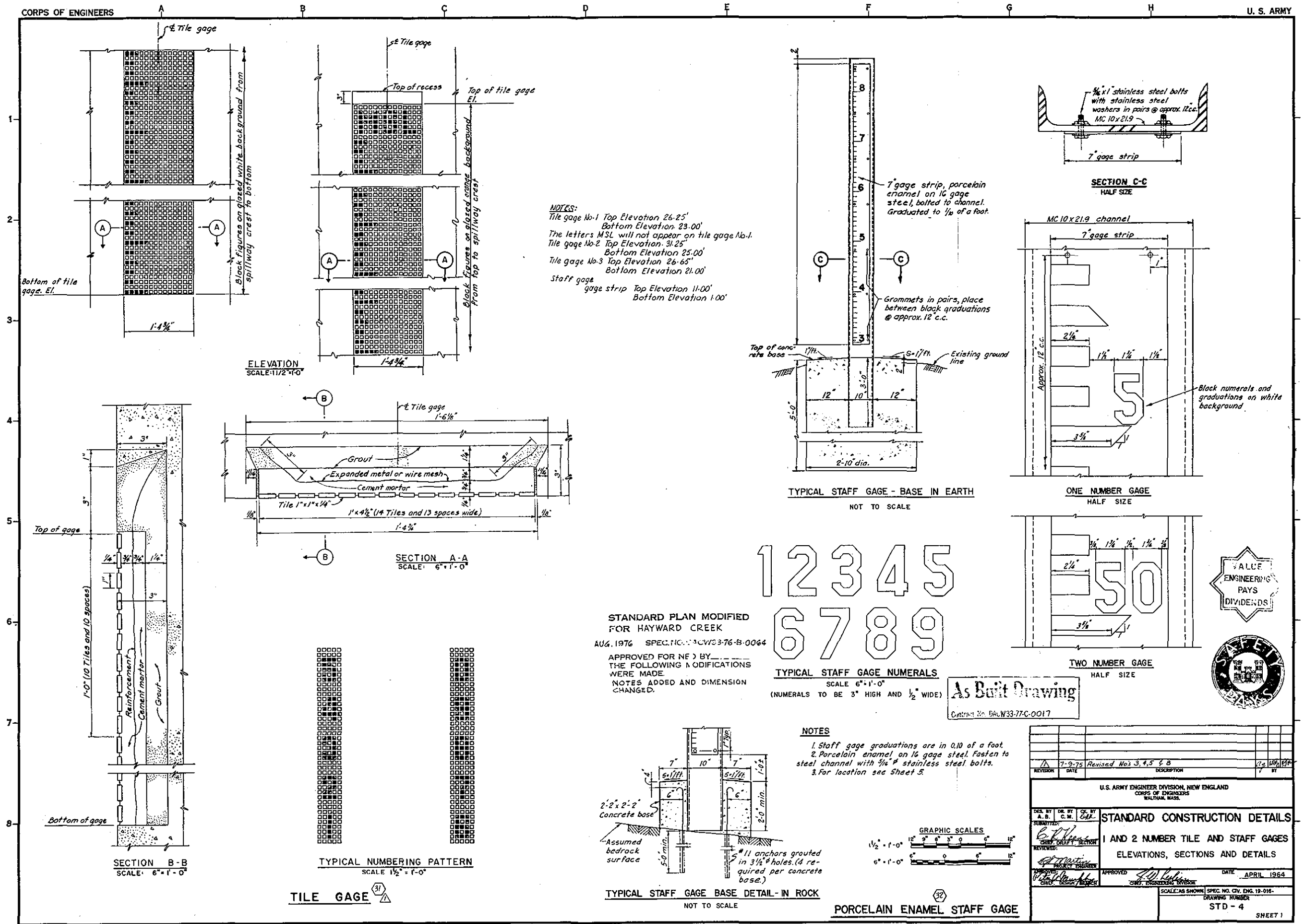
1. For location of 96" Pressure conduit outlet see sheet 19.
2. For location of 30" & 36" collar see Sht. 13.

### As Built Drawing

Contract No. DACW33-77C-0017

[illegible]





VALUE  
ENGINEERING  
PAYS  
DIVIDENDS



U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	
DES. BY A. B. C. M.	CHK. BY C. M.
SUBMITTED 6/1/54	
REVIEWED 6/1/54	
APPROVED 6/1/54	
DATE APRIL 1964	
SCALE: AS SHOWN SPEC. NO. CIV. ENG. 12-016	
DRAWING NUMBER STD - 4	
SHEET 1	

NED STANDARD DWG.